amateur radio

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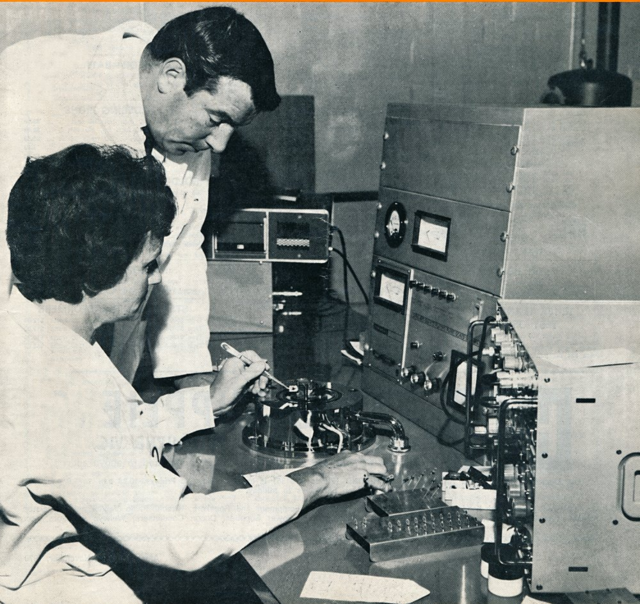

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CONTENTS

COVER STORY

One of the most important processes in the manufacture of high precision, quality crystals, is adjusting to precise frequency by evaporation, under high vacuum. This operation is closely watched by production director, Mr. Ron Taphouse, in the Frankston, Vic., plant of Hy-Q Electronics Pty. Ltd.

COMMENT: FEDERAL

"ONE IN A MILLION"

If you are hungry, and cannot find work, or if you can and you will earn barely enough to feed yourself, and if you have never been to school—why should any hobby, let alone Amateur Radio interest you?

If you live in India and you are a Radio Amateur, you are literally "one in a million"—for in a population of 500 million people there are only some 450 licensed Amateurs.

Some of those 450 licensed Amateurs are by any standard well off. Most are not. Most are not active. They cannot compete with their equipment built with the components available to them, or with the s.s.b. stations of the rest of the world. Who works any a.m. stations on 20 metres these days? Of course components are not the only problem; I was repeatedly told while in India that hobbies are not in the blood of Indians—a hobby is an expression of a restless, seeking, Western society.

I.A.R.U. and we in our Regional organisation seek the development of Amateur Radio in countries like India. We seek to achieve this partly because we believe in what we do and we wish to share it, also partly because we believe that by contributing in some small way to the development of technology in countries like India we are doing something useful in the world around us, and partly for our own protection. It is the last point only that needs explanation.

India, to use it in the present context as an example, has, like us, one vote at International Telecommunications Union Conferences. Why should it vote to support Amateur Radio unless Amateur Radio is contributing something to its national life? The v.h.f. spectrum is a good illustration of the present development of our hobby in that country. In New Delhi I met an Amateur who is able to transmit and receive on 2 metres. There used to be two Americans and an Australian in New Delhi and together they formed a net on Sunday mornings. Now the two Americans and the Australian have left and the local Amateur awaits the appearance of someone else to talk to on 2 metres. Any frequency higher than 148 MHz. may as well not exist—in India you just cannot get the components to even try to make the equipment.

One in a million—that is the problem in India, and the problems of Amateur Radio in India are the problems of India. The two are inexorably intertwined. Is it even realistic to talk of National Amateur Radio Societies and their international organisations rendering meaningful assistance? I do not believe that the solution lies in giving, for example, complete s.s.b. (and expensive) transceivers. This sort of charity obviously demonstrates that Amateur Radio is in fact a rich man's hobby. It teaches nothing and achieves little. The long term solution must be through the education system—such as it is. In India, education is not compulsory. This involves persuading those responsible for education that Amateur Radio as part of say, Science in clubs and schools, is a valuable tool for developing the technology of India.

Some individual Amateurs have had and have used their presence in India to assist Amateur Radio. One example is an Australian, Howard Ryder, VK-3ZJY. During his stay in India as a technical specialist working with the Colombo Plan, he taught other Amateurs how to build their equipment from locally-available products. He was the Australian who started the 2 metre net I have referred to. I do not know whether he will ever realise the affection that those who he assisted have for him. Repeatedly I was asked to ask him to return, and to tell him that they need him.

Amateur Radio needs more people like Howard Ryder in places like India —people who are prepared to work amongst Indians and to know the back streets of Chandnichowk, people who do not spend all their time in foreign lands at the bar of an intercontinental hotel.

There is room also for tangible assistance in the form of those components which are unavailable to India and which are essential to the production of equipment, such as s.s.b. transmitters.

A small boy who has never been to school and will never go to school, and who begs with head bowed while a taxi waits at a traffic light, will never be a Radio Amateur. But there are others who do attend school, who one day given the right training may become Radio Amateurs. It is these people that we must seek to influence. At the same time we lend encouragement to those who already are Amateurs to make sure that they persist with their hobby despite the difficulties that face them. Let us at the same time start at the top with those people who are capable of being Amateurs, and encourage them to become Amateurs and to encourage others to do likewise. Perhaps in our lifetime we may see in India "one in a quarter of a million".

—Michael J. Owen, VK3KI,
Federal President.

MODERN MODULATION SYSTEMS

R. F. DANNECKER, VK4ZFD*

The purpose of this article is to acquaint Amateurs with modulation systems using other than sine waves and continuous signals. Pulse amplitude modulation (p.a.m.), pulse width modulation (p.w.m.), pulse position modulation (p.p.m.) and pulse code modulation (p.c.m.) are discussed, and reasons for their importance outlined

In classical modulation systems, e.g. those represented by a.m., s.s.b., f.m., a continuous message signal is transformed into a modulated transmitted signal which is also continuous (see Fig. 1). Modern modulation systems could be called discrete communication systems. In a discrete system the continuous message signal is transformed into a **discontinuous** modulated signal. The discontinuities can be of two forms, either discontinuities in amplitude or discontinuities in time.

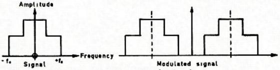

FIG. 1. CLASSICAL MODULATION (D.S.B.)
(Note that both signals are continuous.)

The foundations for such systems were laid by C. E. Shannon working in the Bell Telephone Laboratories (about 1949). Shannon showed that if a normal (bandwidth limited to $\pm f_0$) signal is sampled at (or above) a certain rate, and the sampled values transmitted; the original signal can be reconstructed exactly from the sampled signal. The importance of this result is the word **exactly**. It can be shown that the sampling must take place at a frequency equal to or greater than twice the maximum frequency in the signal (f_0) for this to be true.

Sampling can be achieved by opening a gate (see Fig. 2) at the required rate by a waveform consisting of a series of "spikes". Fig. 3 shows the process. Thus we obtain the simplest form of discrete communication system, namely pulse amplitude modulation (p.a.m.).

In fact the frequency spectrum of the sampled signal is a repeated version of the original signal, the amount of separation between the repeated versions depending on the sampling rate. If the sampling rate is at $2f_0$ this is known as the Nyquist ("nigh-kwist") rate. The period between successive spikes is one nyquist interval. The effect of sampling rate on the spectrum of the sampled signal is shown in Fig. 4. In 4(b) sampling greater than the nyquist rate the repeated spectra are well separated. In 4(c) sampling at the nyquist rate the repeated spectra just touch. In 4(d) sampling at less than the nyquist rate, the repeated spectra overlap.

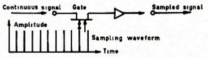

FIG. 2. SAMPLING SYSTEM.

As stated previously, the original signal can be recovered. This is done by passing the sampled signal through a low pass filter which cuts off at frequency f_0 (see Fig. 5). If the sampling were at or greater than the nyquist rate, the original signal has been recovered exactly. If the sampling were at less than the nyquist rate, the distortion introduced by overlapping of the spectra cannot be removed.

This may seem of academic interest only since p.a.m. would appear to offer no obvious advantage over classical modulation. In practice, because of the ease with which this form of modulation may be obtained, it is often the first step in a discrete modulation system. Other forms of modulation are obtained by electronic processing of the p.a.m. wave. One such form is shown in Fig. 6(b). In this form, the pulses are of constant height, but their widths are proportional to the signal ampli-

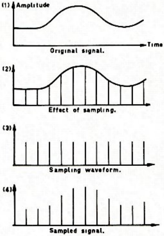

FIG. 3. SAMPLING OF CONTINUOUS SIGNAL.

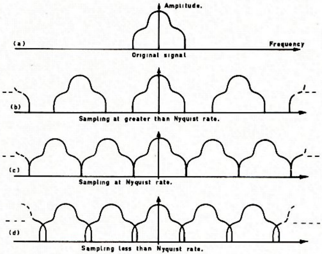

FIG. 4. EFFECT OF SAMPLING ON SPECTRUM.

* 52 Pohlman Street, Southport, Qld., 4215.

tudes at the sampling times. This form may be obtained from pulse amplitude modulation by passing through an amplitude to time converter. This second form of discontinuous modulated signal is known as pulse width modulation (p.w.m.).

If a p.w.m. wave were differentiated, the form shown in Fig. 6(c) would be obtained. The positive going pulse at the leading edge of each pulse contains no information and so could be removed, leaving the negative going pulses shown inverted in Fig. 6(d). In this form of modulation it is the position of the pulse which ultimately reflects the amplitude of the originating signal. This form is called pulse position modulation (p.p.m.).

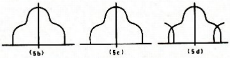

FIG. 5. EFFECT OF LOW PASS FILTERING ON FIG. 4

A fifth form of discrete modulation which requires more consideration than the previous types is obtained if we take each pulse height in a p.a.m.. wave and convert this amplitude into a binary number representing the height.

[The binary numbering system involves powers of 2 while the common system involves powers of 10, e.g. one hundred and sixty-five in the decimal system would be represented as:

$$1 \times 10^2 + 6 \times 10^1 + 5 \times 10^0$$
$$= 1 \times 100 + 6 \times 10 + 5 \times 1$$
$$= 100 + 60 + 5$$
$$= 165$$

in the binary system this would be represented as:

$$1 \times 2^7 + 0 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$$
$$= 1 \times 128 + 0 \times 64 + 1 \times 32 + 0 \times 16 + 0 \times 8 + 1 \times 4 + 0 \times 2 + 1 \times 1$$
$$[= 128 + 0 + 32 + 0 + 0 + 4 + 0 + 1]$$
$$= 1 \quad 0 \quad 1 \quad 0 \quad 0 \quad 1 \quad 0 \quad 1$$

The advantage of the binary system from an electrical viewpoint is that a number can be represented as a sequence of ON or OFF states rather than by a sequence of 10 discrete levels as would be required for a decimal representation.]

Thus a pulse of height 13 volts might be represented by the number 01101 and a pulse of height 20 volts by the number 10100. A different form of modulation would then be obtained if instead of sending a single pulse in each nyquist interval, a sequence of say five pulses were to be sent during that time with each pulse being either a one or a zero, so as to form the binary number representing the original sampled height in that nyquist interval. In this form the sample heights have been encoded into binary numbers and the form is referred to as pulse code modulation (p.c.m.).

It is necessary to limit the number of pulses in the sequence due to practical considerations. If we allow five pulses in each nyquist interval to represent the amplitude of the pulse, then the maximum number of possible different levels which can be distinguished will be 2^5 (= 32). Suppose the maximum voltage in the signal is say 32 volts; suppose also the amplitude of the actual signal at successive sampling times is as shown. Then the binary number (given in decimal form) closest to each amplitude will also be as shown in Table 1.

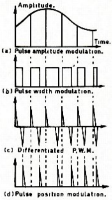

FIG. 6.

In fact the net effect of this finite number of quantisation levels is the same as if noise were added to the original signal. By analogy with this case, the error is referred to as the quantisation noise. Quantisation noise is an additive noise, similar to naturally occurring noise due to atmospherics, etc., in standard communications systems. However, just as the addition of natural noise prevents the exact recovery of a signal, so the addition of quantisation noise also prevents an exact representation of the original message being obtained. Quite obviously the quantisation noise can be reduced by increasing the number of pulses in each sequence. This means that an improved signal will then occupy more bandwidth than previously.

It can be shown that the capacity of a communications system is given by:

$$C = W \log_2 (1 + SNR)$$

where C = capacity of system
W = bandwidth
SNR = signal-to-noise ratio = $\dfrac{\text{signal power}}{\text{noise power}}$

It is clearly seen that given the value of signal-to-noise ratio and bandwith W, the capacity C of the system is determined. Should this capacity not be sufficient for some particular purpose (e.g. high speed data), then either the SNR must be increased by increasing the signal power which is transmitted, which may not be possible, or W must be increased. Increase of bandwidth W is sometimes the only means of increasing system capacity (e.g. spacecraft). There are a variety of ways used to increase W. (In classical modulation f.m. occupies more bandwidth than a.m.) In particular, conversion of the signal into any of the pulse modulated forms which we have considered will result in an increase, so that for a given noise level, the fidelity (readability) of systems employing this method is inherently better than would be obtained if the original signal were say amplitude modulated. This is one reason for the increasing modern use of these methods.

In practice the encoding of p.c.m. can be modified in a number of ways.

To properly decode a p.c.m. sequence (word), the receiver must know the position of the start of each word, or it may decode bits from two adjacent words. To overcome this, a few bits are added at the start of each word, which have a fixed waveform and can be easily recognised. These bits comprise the "synch code," and provide word synchronisation. The total number of bits per nyquist interval must then be greater than the number required to give the amplitude of the signal at that time. The complete sequence, synch bits plus information bits, is called a "frame". (See Fig. 7.)

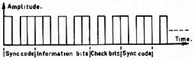

FIG. 7. PULSE CODE MODULATED SIGNAL.

In cases where additive natural noise is present, errors in the received signal will occur, i.e. a 1 may be detected as an 0 or vice versa. This effect can be reduced if to the information and synch bits are added what are known as par-

Nyquist Interval	t0	t1	t2	t3	t4	t5	t6	t7
Actual Amplitude	20.0	19.1	16.5	12.8	3.2	7.7	14.9	6.4
Sample Amplitude	20	19	17	13	3	8	15	6
Error	0	— 0.1	+ 0.5	+ 0.2	—0.2	+ 0.3	+ 0.1	— 0.4

Table 1.

ity check bits. These check bits are calculated on the information bits, e.g. parity check bits are set at 0 if the checked information bits contain an even number of ones and are set to 1 if the information bits have an odd number of ones. If information bits are then altered during transmission, the even-odd correspondence with parity check digits will be altered. This should be detectable by comparing parity checks with information bits, and the bits in error can be corrected A code containing parity check bits in this way is an "error correcting code".

A further advantage arises in the use of a binary coding system in that the receiver has only to decide if an incoming signal is a 1 or a 0 rather than some particular level out of a large number of possible levels. The detector can be a simple level detector to give zero output if the incoming signal is below a certain level corresponding to a 0 and to give an output if the incoming signal is above this level corresponding to a 1. Obviously such a system can be made very accurate even for low SNR and the process can be improved further by the use of optimum or Wiener filtering in the system.

In conclusion it should be pointed out that a practical p.c.m. system is quite complex and, at least for the present, is beyond the financial reach of most Amateurs. Much research is being carried out into p.c.m. and in the future its use will become increasingly widespread.

I should like to acknowledge the valuable assistance given in the preparation of this article by Dr. L. V. Skatterbol of the Department of Electrical Engineering, University of Queensland.

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PROVISIONAL SUNSPOT NUMBERS

JULY 1970

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	137	16	61
2	153	17	59
3	155	18	56
4	159	19	92
5	165	20	92
6	161	21	120
7	125	22	122
8	115	23	106
9	104	24	110
10	90	25	122
11	81	26	138
12	74	27	153
13	79	28	146
14	68	29	153
15	61	30	122
		31	108

Mean equals 112.5
Smoothed Mean for January 1970: 106.2
Predictions of the Smoothed Monthly Sunspot Numbers

August	95	November	89
September	93	December	87
October	91	January	85

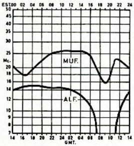
—Swiss Federal Observatory, Zurich.

AMATEUR FREQUENCIES:
USE THEM OR LOSE THEM!

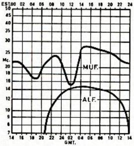
PREDICTION CHARTS FOR NOVEMBER 1970

(Prediction Charts by courtesy of Ionospheric Prediction Service)

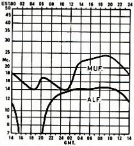
BARBADOS



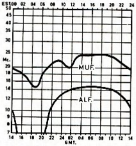
CAIRO



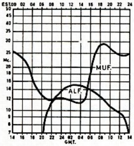
JOHANNESBURG



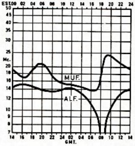
NAIROBI



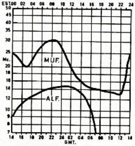
LONDON S.R.



LONDON L.R.



MONTREAL S.R.



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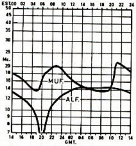
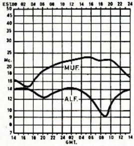
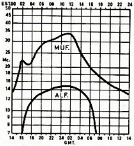


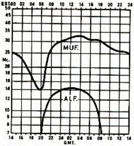
RIO DE JANEIRO



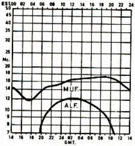
SAN FRANCISCO



TOKYO



WILKES



*THE REPAIR BENCH:**
Doing Your Own Transistor Tests

LARRY ALLEN

To hear some guys tell it, a transistor is the easiest thing in the world to test. But others don't agree. A transistor to them is still a mystery.

Well, the truth is, most transistors can be tested without complicated equipment, gimmicks, calculations, or formulae. To keep it simple, there are just two basic things you need to find out about a transistor: (1) Does it work at all? (2) How well?

TRANSISTOR PARAMETERS

That word "parameters" scares off a lot of Hams. It conjures up complicated graphs with bent lines and long formulae with Greek symbols and big and little letters. All the word actually refers to is **conditions of operation.**

One transistor manual lists 103 possible parameters. They're great for a transistor designer. But a lot fewer is plenty for testing on the repair bench. In fact, I won't even use the term "parameters". Instead, I'll just tell you about the voltages, currents and resistances that tell you how a transistor is doing.

I'll start with the diagram of a simple transistor stage in Fig. 1. This is a grounded-emitter amplifier — probably the most common transistor stage in use today.

The transistor is NPN. Bias is forward when the base is slightly positive with respect to emitter. The collector is "far" positive with respect to emitter.

A PNP transistor takes negative voltage on the base to forward bias the emitter-base junction. That's not necessarily a negative voltage to ground, but to emitter. The collector of a PNP operates "far" negative from the emitter.

WHICH WAY IS UP?

Some Hams I've talked to about transistors seem confused by operating voltages. One key to understanding is knowing how to describe the voltages.

For example, in Fig. 1 if the base voltage changes to 0.1 volt, it has obviously become less positive. That means less positive with respect to wherever you're measuring from, and for most measurements that is ground.

Look at the same voltage with respect to the emitter. As it's labelled on the diagram, the base is normally more positive than the emitter by about 0.3 volt. (The emitter is 0.15 volt, and the base is 0.45 volt; between the two is 0.3 volt, the base more positive than the emitter.)

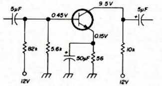


Fig. 1.—Common-base transistor amplifier is popular in Amateur equipment.

* Reprinted from "Ham Radio," July 1970.

Know what that means? "More negative" is exactly the same thing as "less positive". And "more positive" means the same as "less negative".

If the base voltage in Fig. 1 drops to 0.1 volt, the voltage relationship between base and emitter changes. The difference is then 0.05 volt (0.15 minus 0.1 equals 0.05), but the base has become **less positive** than the emitter. That's the same as saying it is **more negative** than the emitter. The emitter-to base bias has become 0.05 volt negative. (Call it emitter-base bias, not base-emitter bias. You want the emitter as the point of reference, so name it first.) An NPN transistor with the base negative is reverse-biased. Collector current can't flow.

This should make clear that, even though you measure voltages with your voltmeter common lead connected to ground, the important thing is the voltage between elements of the transistor. In most transistor stages, your chief interest is the voltage between emitter and base; of secondary interest is the voltage between emitter and collector.

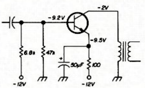


Fig. 2.—Changing polarity of power supply doesn't alter circuit arrangement or operation.

Suppose someone tells you the base voltage on one of these transistors has "gone up". What does that really mean? Usually he means the voltage is higher in the polarity shown on the schematic.

Consider the base voltage in Fig. 2. It appears "lower" than the emitter voltage. Its value is less. Measured to ground, the base voltage is less negative than the emitter voltage. The important thing is this: being less negative, the base is **more positive** than the emitter. That provides forward bias for any NPN transistor.

If the base voltage goes up—that is, if it goes further negative with respect to ground, as the voltmeter measures—the bias actually decreases. Say the meter measures —9.4 volts. The base has become mor negative than it was. Looking from the standpoint of emitter-base bias, it tells you more if you say bias has become **less positive.** Forward bias is therefore reduced. Your voltmeter thus shows base voltage higher than before, but bias is less.

These are important relationships in transistor repair work. The simplest way to combat this seeming ambiguity is to quit using such vague notions as "up" and "down" for voltage measurements. Form the habit of thinking more negative or less negative, more positive or less positive.

TESTS THAT REVEAL

At the repair bench you are usually concerned with a transistor in some piece of equipment. Tests you can make without unsoldering the transistor are the handiest.

There are three ways to evaluate a transistor in that circumstance. Two additional tests can be made if you unsoldered one or two transistor connections.

Finally, two quick test procedures evaluate a transistor outside the circuit. They are especially handy if you have a batch of unidentified transistors you want to check out. Even these tests can tell you more about transistor quality than you might expect.

VOLTAGE MEASUREMENTS

Once you examine d.c. flow in transistor stages, you can figure out a lot from the voltages. If a voltage is wrong, deduction can tell you whether it's the transistor or something external.

Pretend the stage in Fig. 3 is giving you trouble. Your voltmeter tells you the base actually has —5 volts on it instead of the low —0.45 volt that's normal. Think out the possible causes.

Could be one of the base resistors is bad. But collector-base leakage in the transistor is far more likely. You can verify by disconnecting the base lead of the transistor. If voltage on the open base lead is still highly negative, the transistor junction is leaky.

Or, in the same stage, suppose the emitter measures —0.9 volt. For some reason, more current than normal is flowing in the 52-ohm resistor the emitter voltage is measured across. The transistor is probably drawing too much current.

But is that due to overbias or a transistor defect? If base voltage has remained about the same, the trouble is likely in the transistor. You see, —0.9 volt at the emitter, with only —0.45 volt at the base, constitutes reverse emitter-base bias for this PNP tran-

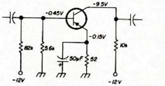


Fig. 3.—PNP transistor in this basic amplifier works the same as NPN; only change involves voltage polarities on the various elements.

sistor. That would reduce current through the transistor, not increase it —**unless** the transistor happens to be defective.

There are plenty of other examples of this kind of reasoning. Just remember which polarity of transistor you're dealing with and the likely effects of voltage changes. And don't forget to interpret voltage measurements in terms of their relation to each other and to the transistor itself.

The other two in-stage test ideas utilise a transistor's bias characteristic. For most transistors, zero and reverse bias cause zero collector current. A healthy forward bias assures significant collector current. These precepts of course apply only if the transistor is not defective.

The first test is for stages in which the transistor operates with forward bias. You can determine that from the schematic. Remember, forward bias is base-positive for an NPN transistor and base-negative for a PNP.

Connect your voltmeter at one of the points shown in Fig. 4. Several possible connections are illustrated. If you need it, you can insert the 100-ohm resistor;

For instance, the NPN transistor in Fig. 4A has forward bias only when the base is more positive than the emitter. How do you make it more positive? One way is to reduce the value of the supply resistor, since it goes to a positive voltage source. Just bridge it with a low-enough resistance to make the base more positive than the emitter. If the transistor is working normally, the voltmeter shows more collector current.

In Fig. 4B the basic supply scheme is different. But the transistor is still NPN. Forward bias requires base to be more positive than emitter, same as always. But how can you make it that way? Just remember that more positive is the same as less negative. Bridge a lower resistance from base to ground, low enough to reduce the base voltage to a value less than at the emitter. Collector current goes up. If not, the transistor isn't responding as it should.

The transistor in Fig. 4C is PNP. Forward bias demands a base more negative (less positive) than the emitter. It should by now be easy for you to figure how to make this base less positive. When you do, the voltmeter should register higher collector current.

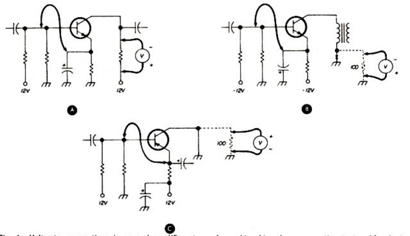


Fig. 4.—Voltmeter connections in several amplifier stages for making bias-change operation tests. Idea is to eliminate bias on stages that normally use forward bias and add it to those that don't, while watching the change in collector current. You can add a resistor if the collector circuit doesn't have one.

its value won't bother the circuit much. Indirectly you are measuring collector current.

Notice the voltmeter reading. Then clip a shorting jumper between base and emitter. The voltmeter reading should drop to almost nothing. If it doesn't, the base isn't controlling collector current.

The second test is for stages where zero or reverse bias is normal. (The transistor may conduct, but probably during only a small portion of each signal cycle, leaving an **average** or d.c. bias that is zero or reverse.) The voltmeter connections are the same as in Fig. 4.

This time, instead of eliminating bias by shorting base to emitter, you apply a definite forward bias to base. Figure out from the schematic what would constitute forward bias for the transistor. Then somehow alter the bias to make it temporarily forward. The meter reading should take a definite move upward, signifying more collector current.

DETECTING ABNORMAL LEAKAGE

Those tests let you know a transistor can control its collector current. That's the key factor. But there's another factor that can keep a transistor stage from performing up to par. You need a way to check **leakage.**

Basically, it's easy. Your voltmeter and soldering gun are the only equipment you need.

The leakage that can most upset stage operation is from collector to base. The collector junction of an operating transistor has a high reverse bias. If that junction lets "carriers" through in the wrong direction, transistor gain is poor.

To measure collector-base leakage, disconnect only the base lead of the transistor. Clip the voltmeter common lead to the emitter. Set the voltmeter as if you were measuring collector voltage. Touch the other test lead to the free end of the base lead. Voltage there should be almost non-existent. Unwanted leakage lets current across the junction to the meter.

TESTING OUT-OF-CIRCUIT

If you have a transistor tester, fine. With a good one you can test transistors in or out of the stage faster than with the tests I've outlined here. But if you don't have one, you may often need these procedures.

Tests outside the stage are popular with Hams. The basic instrument is your ohmmeter. There are two main purposes. One is identification. The other is evaluation.

Hams often pick up transistor "bargains". You met a handful of odd-lot transistors, often unmarked or marked in some way that means nothing to you. You may not even know which wires go to emitter, base, or collector. Here's how to settle these doubts.

An ohmmeter with 1.5 volts or less between the test leads is safest (measure with some other voltmeter). More voltage might pop a transistor junction. Also, notice which test lead has the positive voltage and which the negative; you'll need to know for these tests. Nowadays, it seems most ohmmeter batteries are connected with positive voltage on the common or black test lead.

Pick any two transistor wires. Clip the ohmmeter to them in first one direction and then the other. If you get no reading, try another pair, again measuring in both directions.

When you get a low ohms reading (150 or less), one of the ohmmeter leads is clipped to the base wire. The way most transistors are arranged, it is the wire in the middle.

But you can make sure. Leave one ohmmeter lead clipped to the wire you think goes to the base. Move the other lead to the remaining transistor wire. If the ohmmeter reading is again low, the lead you didn't move is definitely clipped to the base. If not, the one you moved was.

You can now identify the transistor type. When you get low readings to both other elements with the positive ohmmeter lead connected to the base, you are testing an NPN transistor. A PNP transistor gives low readings when the negative ohmmeter lead is clipped to the base.

You've identified the base, but you don't know which of the other two wires goes to the collector. There were clues in years past, but you can't trust the dots, stripes, and tabs on today's myriad of transistors. And basing diagrams aren't standard enough to help much either.

Start with the ohmmeter connected to show low resistance between the base and either of the other elements. You know which wire is base, so unclip that lead and move it to the other unidentified wire. The meter should read infinity, or open. If not, the transistor is defective.

Then click the range switch of your ohmmeter to higher scales until you see a slight downward meter deflection (something less than infinity). This usually happens on the Rx10K or Rx100K range. Next, reverse the two ohmmeter leads. The ohms reading will

(continued on page 16)

An Outside Broadcast Amplifier

LECTURE NO. 9 C. A. CULLINAN,* VK3AXU

- Continuing the series of lectures by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

The original 3CS O.B. Amplifier No. 4 was manufactured in 1960 and after considerable work it could no longer meet the Australian Control Board's standards.

It was decided, therefore, that as part of our training programme that this amplifier would be dismantled and a new one built to take its place, the work to be done by our Cadet and to correspond with the appropriate part of the Marconi School course. The new amplifier would use as many components as possible from the old amplifier but would be different in mechanical construction and somewhat different in circuitry to avoid making a direct copy, as it was felt that little was to be gained in tuition in making a copy.

DESIGN AND NOTES

A single channel Outside Broadcast Amplifier to be built using valves and operated from the a.c. mains.

The amplifier must meet the Australian Broadcasting Control Board standards, and, where applicable, Australian Post Office specifications.

The only suitable output transformer, which was available, was an A. & R. type OT2629 for which a manufacturer's test certificate was held (22/4/69), in respect of A.P.O. Specifications 1053 and 1054.

Details of this transformer are:

- Primary Impedance: 7,000 or 5,000 ohms, single ended.
- Secondary Impedance: 500, 250 or 125 ohms.
- Power Rating: 5 watts.
- Frequency Response: 50 Hz. to 30 KHz. ± 2 dB.

Output Valve

The output transformer is suitable for use with any valve requiring a plate load of 5,000 or 7,000 ohms, and taking a plate current of 50 mA. Thus the choice falls mainly between types EL84/6BQ5, 6M5, 6GW8 or 6V6GT. As a large number of EL84s are used in studio equipment, this type was chosen as the output valve, with 160 ohm cathode bias resistor. A simple resistor of this value was not available so some calculations were made to determine which of two 3 watt w.w. resistors on hand would give the necessary value when used in parallel. The two resistors selected were 250 ohms and 450 ohms, which in parallel become 160.7 ohms.

Other Valves

In order to meet the specified noise figures it is essential that the other valves must be of very low noise type and for this reason EF86 valves were selected. This type was first available in Australia somewhere in late 1954 to 1955. It is also known as 6BK8/Z729, and was specifically designed for use in low level microphone or pick-up pre-amplifiers. It uses a 9-pin miniature base, has internal shields and a specially constructed heater-cathode system.

It is possible with proper design of equipment to reduce hum and noise voltages, referred to the control grid, to the order of 1.5 μV. for hum and 2 μV. for valve noise for an audio frequency bandwidth of 15 KHz.

In recent years an improved EF86 has made its appearance. For this valve, the previous mesh type anode (plate) has been replaced with a solid one. This gives additional shielding and reduces pick-up of external magnetic fields (hum) by as much as 6 dB.

It would appear that the EF86 is a later development of the valve type EF40.

For many years the designer has used EF86 valves as pentode audio frequency amplifiers with a plate load of 0.22 megohm, a screen resistor of 1 megohm, and a cathode resistor between 2,200 ohms and 3,000 ohms. With a cathode current not in excess of 1 mA. and cathode bias not less than 1.6 volts, excellent gain, low distortion and low noise have been achieved for a bandwidth of 15 KHz.

If they are available, the student is referred to the following publications for further details of the EF86/6BK8/Z729 valve:

- Radiotronics, Vol. 20, No. 6, June 1955.
- Radiotronics, Vol. 22, No. 5, May 1957.
- Mullard Circuits for Audio Amplifiers.
- Philips Valve Data Handbook.

Calculations showed that with a microphone transformer having a turns ratio of 1:44.7 and a 6 dB. attenuator between the output transformer secondary and the amplifier output terminals, the specified gain of 80 dB. could be obtained by using two resistance coupled EF86 valves and an EL84 output valve, whilst applying considerable feedback over the last two stages.

Thus the amplifier portion of the design resolves itself into a three-stage amplifier, using EF86s in the first two stages with an EL84 in the output stage. Negative feedback to be used from the plate of the output valve to the cathode of the second valve.

Because the specifications state that the output of the amplifier is to be balanced and floating, it is not possible to use negative feedback from the secondary of the transformer. Also, the particular output transformer does not have a tertiary winding for feedback purposes, therefore the feedback was taken from the plate (anode) of the output valve.

The input transformer is of the specially shielded type made for low level applications. The heavy shielding reduces hum pick-up as much as 40 dB. below that picked up by a similar, but unshielded transformer.

The gain control is located, electrically, between the first and second stages.

POWER SUPPLY

The specifications stipulate that silicon diodes are to be used as rectifiers in the power supply.

S.T.C. EM410 silicon diodes were used as they were in our stock of spare parts. These diodes have the following characteristics as abstracted from an S.T.C. I.T.T. Application Note:

- Peak inverse voltage (p.i.v.), 1,000 volts.
- Average rectified current at 85°C., 0.5 amp.
- Operating and storage temperature range, —55°C. to +135°C.
- Voltage drop approx., 1.2 volts.

Consideration was given to the use of an Ironcore T5/102 power transformer which was available and was suitable. The following information was extracted from the maker's data sheet:

- H.t. secondary voltage, 225-0-225, i.e. 225 volts each side of the centre tap.
- H.t. secondary current, 50 mA.
- Heaters, 6.3 volts at 2 amp.

An astatic shield is fitted between primary and secondaries to reduce capacitive coupling between these windings. In addition, it has an external eddy-current shield.

As the h.t. secondary has a centre tap, this means that a full wave rectifier circuit must be used.

Having selected the power transformer and the type of silicon diodes, it becomes necessary to determine how many diodes will be needed.

The term peak inverse voltage means the peak voltage that the rectifier can withstand in the reverse direction before it breaks down. This voltage includes both a.c. voltage and the d.c. output voltage.

Other terms used in place of peak inverse voltage are crest working reverse voltage (v.r.w.m.) and peak reverse voltage (p.r.v.). They all mean the same thing.

Now one of the characteristics of silicon diodes is that they are very liable to break down the moment the p.i.v. is exceeded. Some will be destroyed instantly, but others will recover if the excess is not too great.

Again from S.T.C.-I.T.T. Application Note, we take the information to enable us to determine the various voltages to be expected.

P.i.v. = 3.14 × volts out.
V.r.m.s. = 1.11 × volts out.
Volts out = volts r.m.s. ÷ 1.11.

* 6 Adrian Street, Colac, Vic., 3250.

Volts r.m.s. is the r.m.s. voltage from the h.t. centre tap to either high voltage end of the h.t. secondary winding.

Now let us do some calculations.

The a.c. r.m.s. voltage across one half of the h.t. secondary is 225 volts. Therefore the d.c. output voltage will be:

$$225 \div 1.11 = 202.7 \text{ volts}$$

and the p.i.v. will be:

$$202.7 \times 3.14.$$

However, this is for a choke input filter, but when a large condenser is connected across the output of the filter and the power supply is switched on, the output voltage will be much higher until the filter input condenser becomes fully charged and the valves have warmed up.

At the instant of "switch on" there is practically no load on the power supply so the output voltage of the rectifier system soars considerably.

In this amplifier the measured d.c. output from the rectifier at "switch on" was 340 volts.

For safety, it is necessary to take this new voltage as the d.c. output voltage (when the amplifier is warmed up this voltage will drop to 250v.).

Therefore the p.i.v. will be:

$$340 \times 3.14$$
$$= 1{,}067.6 \text{ volts.}$$

To allow for variations in a.c. mains voltages, also switching transients that may show up in the a.c. mains, it is desirable to add at least 25% to this value, i.e. 1,067.6 + 266.9 = 1,334.5 volts.

The simplest way to accommodate this voltage is to put two diodes in series in each leg of the transformer. We selected EM410 diodes as they are rated at 1,000 p.i.v.

When a large condenser is used at the input of the power supply filter it is necessary to protect the diodes from burning out due to excess current through them as the rectifiers start to charge the condenser.

To avoid this problem, it is necessary to use a transformer having sufficient impedance to restrict this current flow or to put resistance in series with each h.t. leg of the transformer.

In this design, the 80 μF. condenser is not excessively large and the impedance of the power transformer keeps the current within the limits of the diodes.

One problem of putting diodes in series is that sometimes they will not share the voltage between them, therefore a 1 megohm 1 watt resistor is wired across each diode.

PRACTICAL NOTES

The lead from the microphone transformer to the grid of the first EF86 was made as short as possible and shielded with braid fitted loosely to reduce the capacity between the lead and the braid.

A piece of ¼" o.d. co-axial cable was used as the lead between the 0.022 μF. coupling condenser and the top of the gain control, which was about 4" above the top of the chassis. The braid was earthed as close to the 0.022 μF. condenser as practicable. The other end of the braid was connected to the "earthy" end of the gain control. The gain control was not earthed in any other manner.

The lead from the arm of the volume control to the grid of the second valve was also a piece of co-axial cable, with its braid earthed as close to the grid as possible. At its other end the braid was insulated so that it could not touch anything.

All these precautions were taken to reduce, as far as possible, frequency loss at the higher frequencies.

As part of tuition, the co-axial cable was replaced with tightly woven shielded wire. The frequency response at 10 KHz. immediately dropped to 5 dB. below that of 1 KHz.

Heater leads: The heater leads between the EF86s and the EL84 were twisted and shielded, also care was taken in the layout so that no heater lead passed near a grid pin in a valve socket.

Headphone Jack: This was insulated from the chassis to maintain a floating output as specified. Two 560 ohm resistors prevent a short circuit across the amplifier output should the headphones plug not be properly inserted.

Layout: An aluminium chassis was used to reduce hum transfer from the power transformer to the input transformer, as could happen with a steel chassis.

The power transformer was mounted in a rear corner of the chassis. The location of the output transformer was determined as follows:

After carefully insulating leads, a.c. power was fed to the power transformer to energise it.

Then a 7,000 ohm resistor was wired to the 7,000 primary of the output transformer and the 500 ohms secondary was connected to the A.W.A. Noise and Distortion Meter.

The 50 Hz. (hum) pick-up from the power transformer was measured with the N. & D. meter, after which the transformer was moved over the surface of the chassis to locate the position of minimum hum.

The location of the microphone input transformer was determined in a similar manner, using the high impedance input to the N. & D. meter connected to the transformer secondary, the primary being terminated with a 47 ohms 1 watt resistor.

Locating the transformers in this manner proved to be most successful as no hum can be detected in the completed amplifier.

The amplifier was fitted into a metal case, with carrying handles.

It is a matter of great satisfaction that the completed amplifier meets all the designed specifications and is a welcome addition to the station's O.B. equipment.

☆

SOLDERING IRONS

A range of corrosion resistive soldering irons in a variety of bit sizes and wattages for radio work is now available. Manufactured by Birko Electric Pty. Ltd., these soldering tools have a stainless steel casing, and are fitted with a no-heat transfer moulded handle. Power ratings for the 230v. a.c. types ranges from 40 watts to 80 watts in the radio work purpose models, and 130 watts to 200 watts for the general and workshop heavy duty models. An instant heat model, with a finger touch heat control, operates from 3 to 6 volts d.c. or a.c. (through step-down transformer) will be found ideal for Amateur work.

A technical brochure is available on all models from Birko Electric Pty. Ltd., 26 Victoria Crescent, Abbotsford, Vic., or from electrical and radio wholesalers.

ANTENNA FARMING

A. J. C. THOMPSON, VK4AT*

A 10 element long type Yagi on 7 MHz.—a.m. at s.s.b. strength.

The reaction to the above circumstances have followed a fairly set pattern. Some were expected, some should have been expected, some were quite unexpected. From the reports received, the following are fairly representative:

(1) The fact that it is a.m.
(2) The unexpected strength.
(3) The good quality of the transmission (where the gear was capable of judging it).
(4) The way it bashed down the QRM.
(5) Its good effect on QSB.
(6) Its effect on the background noise level.

In addition to the above, the most interest was taken in:

(1) The number of elements used on 7 MHz. (10 or 13).
(2) The low height (20 feet poles).
(3) The use of steel wire.
(4) The valley QTH.
(5) Why such a scheme was attempted.

I will try and get things straight right here. This article cuts no new ground scientifically. It does deal with some theories, but only the practical application of them, that would not be found in text books or come to the notice of Radio Amateurs under normal circumstances. I am not an expert on any subject because I write about them, or because I can make such a row in the Southern States on 7 MHz. at night time. All these things came about because my QTH is in a very short valley completely surrounded by hills. 120 foot towers fail to bring in the t.v. channels from Brisbane, 100 miles distant. 7 MHz. is equally unco-operative, but 3.5 and 14 MHz. (also some other bands) appear to be much better.

It is evident then that sheer necessity is the driving force behind the construction of this antenna farm. Being an antenna farm, ease of construction is a must. Such construction means light-weight gear just as it does in industry. It also means low costs. Probable gain must be in proportion to both the work involved and the costs. This is a ratio—work and costs against gain. It sets the pattern at all times. An application of this ratio to the long type of Yagi will dampen a lot of enthusiasm. It means much work—low costs—much gain and in addition an area or boom length in proportion (half an acre for 7 MHz. [0.9 acre for 13 elements], quarter of that for 14, etc.). Interested persons will now only be:

(1) Those with adequate areas,
(2) Scouts Clubs, etc., with more enthusiasm than cash,
(3) V.h.f. where boom lengths cause no dismay.

Such a beam was constructed on Channel 4, necessity being the driving force on that occasion also. For the benefit of those with little interest in Yagis, a little explanation is necessary. Maximum gain necessitates very critical tuning of the beam. This in turn means the use of gear beyond our reach. The same results can be obtained from book-values (with much less critical dimensions) by the use of more elements. For example, I spent months tuning up a 5 element Yagi and then found that I had the same spacing as those given in a text book.

For a practical explanation on the use of Yagis, I will take the position right here. Such a beam with 5 elements was already working quite well on 7 MHz. and I desired more gain. More elements meant two posts and two poles for each additional element. If I added an element at 0.1 wavelength spacing, the gain was small and in addition it could easily upset the impedance, and so be less. In the alternative method, that of re-constructing the whole antenna at 0.35 wavelength spacing, the work-cost-gain ratio was also unfavourable. Either the gain had to increase or the work decrease. Such an unlikely event actually did occur with the published reports of this combined type of Yagi. In it (now called the Long Type Yagi) the high gain of the original Yagi was retained in the front end of five elements and, without upsetting the impedance values, the additional elements at 0.4 wavelength spacing were added. Two things made this possible:

(1) It was ascertained that it was not the number of directors used that gave the gain, but the boom length that they occupied, provided that the ratio space-length-diameter of el. was adhered to.
(2) At that distance and spacing, the additional elements did not upset the impedance of the driven element.

These circumstances made the ratio work-cost-gain very attractive. Construction on both 7 MHz. and Channel 4 were commenced. An additional characteristic was the fact that the back-to-front ratio increased with closer spaced elements, but wider spaced elements of this magnitude gave good signal side rejection. This latter characteristic looked good as an image rejector on Channel 4. Our very local t.v. translator put beautiful images on our sets corresponding to a mountain rock face plus five timbered high spots on the ridge opposite. With the aid of an iron roof, suitably positioned, and this type of Yagi very good pictures resulted.

The antenna took only a couple of hours to construct. It was made from the plastic covered type of conduit (10 cents a foot) with No. 10 fencing wire inserted and soldered. This gave a very firm connection, and the elements could be bent at any angle. Joins of the conduit are easy with a 6 in. saw cut and a starter of another inch. This shows that quick, easily constructed beams for v.h.f. are possible for casual experiments. Conduit is available in various lengths and diameters. The sag involved on the longer lengths are easily braced.

Now to return to the set-up here on 7 MHz. Steel wire of 14 or 16 gauge was used of the type used on fruit cases. The weight and strength was far beyond what was necessary, but it was available on this farm. Fence posts and poles were also available, but were also much heavier than was necessary. The insulators used were very light and efficient, being ½ to 1 inch cut off 1 inch diameter water pipe of the polystyrene type. Higher grades may be better, but some are weather affected. Much relevant material will be found in a previous article ("A.R.," March 1970). Because of the scaling factor, experiments can be changed from one band to another, although "doubling up" too much runs foul of the fact that you are not scaling up the surroundings too.

In the previous article it was shown that on 14 MHz. the forward gain dropped sharply when the antenna was lowered from quarter to eighth wavelength height. This deduction was based on the fact that W land, on which it was aimed, decreased in strength, while the JAs came up. A perusal of many text books gave little information on this problem. Most of them stop at half, but a few go to quarter wavelength height. By continuing a graph, it was assumed that the difference in the angle of radiation would be in the vicinity of 8-10° for one-eighth and one-quarter wavelength heights. Against this assumption was the extraordinary behaviour of antennas at:

(1) Ground level,
(2) A few inches underground,
(3) Inside metal pipes, both open and closed,
(4) Wire in water.

If you want a headache just read about those things. One significant fact emerged. At zero height, much gain was lost, but the signal-to-noise ratio was more favourable. If then, the gain lost by reducing the wavelength height down to one-eighth could be recovered by adding more elements, then the signal would come up more than the QRM. On such a band as 7 MHz., this matter is of major importance.

From my own experience, further experiments seemed to be futile, but a 5 element Yagi at one-eighth wavelength height on 7 MHz. had actually shown some gain. It was decided to change the experiments from 14 to 7 MHz. and accept the loss due to the lower height, because the use of 20 ft. poles made the scheme a practical proposition. As previously mentioned, the adverse ratio work-cost-gain at one-eighth wavelength height prevented further advance. When the new type Yagi was investigated it was decided to put the extra five elements on in one big heap.

A glance at the sketches show that Fig. 1 Section A is just a typical type of 5 el. Yagi except that the reflector

* Skyrings Creek, Pomona, Qld., 4568.

spacing is 0.24 instead of 0.25. That spacing was evolved using a double wire, spaced 6 inches, for the reflector. (Changing it to a single wire landed me in strife.) Section B of Fig. 1 represents the changed Yagi via the new type spacing of 0.4 wavelength, the joining director being at spacing 0.2 wavelength, but 0.4 for this also is in order.

Fig. 2 shows how the nearest two directors and the reflector were changed over to give a 4 element beam of enough gain for skeds in VK9 land (north). This 7 MHz. beam is on a compass bearing of S from a position approx. 70 nautical miles NW from Brisbane.

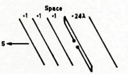


FIG.1. Section A. 5 EL. YAGI.

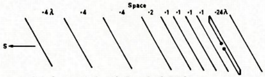


FIG.1. Section B. 10 EL. LONG YAGI.

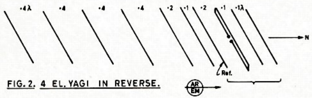


FIG. 2. 4 EL. YAGI IN REVERSE.

Of interest at this point is that the two-wire reflector represented quite a different effect on the impedance of the driven element than a single wire, or of that wire plus 12 inches. The factors concerned are that a folded dipole, if altered to the shape of a quad, could not have a director or reflector of a single wire. In this case, I had added three more elements to the 10 mentioned, but the gain was well down until I reverted to the original double wire reflector of 5% longer than the three-wire dipole.

From the above it is clear that the first five elements of the Yagi must be in order before the other elements are added. At this QTH the gain of the second group was far beyond that of the first group, but as explained previously, the QTH position absorbed the initial gain. The results were astonishing, especially at the other end where friends had spent years straining their ears in my direction. If I had any sense at all I would be sitting back enjoying the performance of this big beam. Instead of that, I exhibit my ignorance and show others how to equal in four days the results that took me four years to obtain.

As this article is aimed at helping (1) the bottom half, (2) the young, and (3) the inexperienced groups, much detail in construction work is necessary. It is hoped that the many problems mentioned will create a desire to solve them. It is quite clear that initially neither much money or knowledge is necessary for experimental work. For a genuine experimenter, assistance and sound technical advice is available at all times just by crying into the mike. Antenna design, progressing mathematically, leaves many gaps that can be better probed by a practical organisation such as ours, but there is little encouragement for our new members when all awards go for DX, and quality is down in the doldrums. If we lift the quality of our transmission, then Amateur Radio will get a push-up instead of its customary push-down.

On 7 MHz. quality is useless unless it rides free of the QRM. It is here that beams become important because (1) of their effect on the signal-to-noise ratio, (2) their ability to restore the strength after other methods that were used to improve that ratio had reduced the signal strength, and (3) the beam effect being added to the receiving improvement. If we get right down to basic requirements then we must realise that the fellow at the other end is the judge, hence we should:

(1) Put out a good quality signal,
(2) Put that signal well above the QRM,
(3) Use a beam on our receiver to lift his signals up.

Although 10 elements are the basis for this article, another three were added later and an AX0 was worked on phone at R5 S6 almost immediately. At this stage, it is again emphasised that only ease of construction will make this antenna popular on 7 and 14 MHz. It is necessary to fully understand where the strain on the gear will be felt. Take a look at Fig. 3. A pole fastened to a post is similar to a long lever at B with the fulcrum at ground level, A, and moving the bottom of the post at C. Therefore ram the bottom well, also the top. Stones are useful. If using steel posts for a more permanent fixture, a wider board driven in on the inside gives a better support, but cement on the top of the ground is the best. Steel posts cost about 90 cents, 3 x 2 inch hardwood from demolished jobs is cheap and sound. These can be driven in with an axe, but in hard ground drive a crow-bar in first.

For experimental purposes, queer things have been tried. T. & G. 4-inch floor boards bolted together for the 20 ft. required have been in use for six months. Steel posts have given satisfactory service. The old type conduit is good and light. For the fixed portable —sections similar to tent poles can be joined, using either conduit or polystyrene piping for the joins and bamboo for the top section. If home-brew type is desired, suitable boards can be sawed by nailing to an upright 3 x 2 with the required edge protruding and the saw guided by the upright. Thin poles will have to have support from nylon string. Bricklayers' twisted nylon string has been used here for use on the elements. Small metal rings can act as pulleys for erecting the element wires and also for bracing the light poles.

With the pulley at its correct height, the minimum length of nylon string for raising the elements is such that you can reach both ends. Aligning the elements is tricky but it is quite easy if you use a plumb-bob (a big nut on some cotton). With the posts in position, work from the centres. Mark the centres of the elements with dark tape. Fasten to the centre peg and complete the element wiring for that approx. length to the end poles With the centre pegs all in line raise the elements themselves. (It is advisable to join the centres of the dipole and three directors together at the right distance with nylon string.) By holding the plumb-bob up at arms length all elements can be aligned with respect to their pegs. Another method that I use is to hang a white cord from the reflector centre then from the centre peg of the furthest element align that reflector cord with a mark on the opposite hill, then advance toward it, aligning each element. Small changes are easily made on fixed elements by ramming the posts on one side.

For the "portables" some experimenting has been done. These particular measurements are only approximate. They were taken without a tape by lowering the end. The dowel used was holding up the tenth element of a Yagi beam on 7 MHz. The wire in use was 16 gauge steel, the length being 70 ft. plus about 5 ft. folded back and with two light insulators. Only the slightest of bends was observed in the 18 ft. of 5/8 inch dowel (two sections of 9 ft.). The type used was the kind popular for window curtains. 50 ft. of nylon string was also required. If you look at Fig. 4, it will show you how to get that dowel

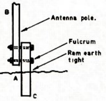


FIG. 3. POLE BASE.

up without it making figure eights Fasten the nylon string to the top of the dowel and the wire of the element. It needs 24 ft. on each side to go to the pegs. With the dowel lying along the dotted line, follow it until the string to peg B and the element come tight. At this stage the top of the dowel will rise until the pull from the other peg (A) halts the rise. Now align the bottom for least bend in the dowel, which in this case came about 3 ft. towards the other end of the element, from the vertical position.

To join the two sections of dowel, look at Fig. 5. Again using polystyrene water pipe of 1 inch diam, cut off two sections 5 inches long. Leave A intact, cut down B for the full length and then fold it until it will slip inside A. Now take a 6 inch length this time and cut out a section 1 inch wide down the whole length (or such a width as will enable it to fit inside the second tube). The protruding ½ inch at each end should have about five cuts ¼ inch deep to let it expand for easier entry of the 5/8 inch dowels.

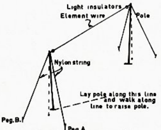


FIG. 4. ELEMENT SUPPORTS.

We come now to "spacers". Polystyrene and its class have good qualities. They are light and being 1 inch in diam. (in this case) they get over the "twisting" habit of home-brew lines. If you look at Fig. 6 it will show how to hold these slipper things while you operate on them. Fig. 7 has the holes spaced at six times the diameter of the wire for 300 ohm use—note the exact way the cut enters the hole and the side on which the nick is made. This gives a flap that can be twisted sideways to let the wires be "clipped" on.

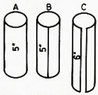


FIG. 5. DOWEL JOINERS.

If you were to extend this drawing to accommodate one more hole in the centre between the two that are already there, you would have the 3 element folded dipole that is used in this and the former beams. These spacers were strung through the centre holes for the centre wire, then spaced in a distance of a couple of feet, then the top and bottom wires were "clipped" on. Lack of space prevents me from explaining why they don't twist even after a couple of years and probably a hundred up and down trips. For your information, warm these things in the sun. They can then be cut quite easily.

Another problem is wire. Hold the coil in the left hand and after fastening one end, walk backwards peeling the coils off to the right, say five turns, then hold it in the right hand and peel off five turns on the other side. This cancels the twist.

Now to conclude. This work is not a one-man effort. Assistance has been given freely by all Amateurs called on. The main ones concerned have been VK2BAI, of Sydney, the "Man Friday" who has spent four years (with only one break of a few months) giving band conditions, reports, etc., at 2100 hours or 2000 E.A.S.T. Also VK4LN, of Gympie, 20 miles distant, who shouldered the responsibility of keeping everything in order and also supervised the quality of the transmissions at all times. Theory and technical advice came also from VK4XR, of Gympie. The transmitter in use was a.m. with 120 watts.

Before closing I will draw your attention to a few points:

(1) The effect of wavelength height.
(2) The importance of the signal-to-noise ratio.
(3) The effect of this type of Yagi on that factor if extended to a useful limit of six wavelengths of boom length (two wavelengths used here).
(4) The signal side-rejection characteristic.
(5) The comparison of gain in the two sections of the 10 el. Yagi, which in my case was influenced by the valley QTH position.
(6) The fact that the same receiving station could issue one report using a receiver for a.m., another while using an s.s.b. transceiver, and a third using his guess meter. Poor old Prof. Einstein would have thought that all his efforts in writing of the need of a common "measuring stick" had been in vain.

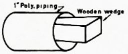


FIG. 6. PIPE HOLDER.

A little comment is necessary on the signal-to-noise ratio as it applies to both transmit and receive. I have assumed that an antenna with a good S to N ratio will act similarly on both transmit and receive. This is based on two factors, (1) the law of reciprocity (its application to beams was quoted in a previous article I think on Rhombics), (2) on a curious report received from VK2BAI where the QRM was bashed down generally, but one distant signal was still there and came **up** riding in on the beam. This does not necessarily mean that we broadcast our own QRM, that question should be split up into many components.

This completes this article, but in the construction field the principles of a few items should be fully understood. For home-brew lines, for example, take three pieces of the steel wire quoted and insert them in the water pipe as described and see how the cylinder construction effects both the twist factor and the distance apart required. For the 18 ft. dowel of 5/8 inch diam. construction, use two pins and cotton plus a straw out of the millet broom to represent the antenna problem, and how to fix it so that the strain comes on the upright in the position where it stands it best. For the join of the two sections of dowel, 1 inch piping was used because it was available, but ⅞ inch can be purchased, also suitable conduit.

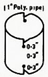


FIG. 7. LINE SPACER.

No work has been done on wavelength heights below one-eighth. I trust that others will see the possibilities in this changed type of Yagi. If it does not suit our methods, then we might alter our methods to suit it. If we look at our award system then we can come to no other conclusion than to regard Amateur Radio as a play-toy, not an experimental group.

☆

THE REPAIR BENCH

(continued from page 11)

either go lower or return to the infinity end of the scale.

Connect the leads for the lower reading. Of course they are between emitter and collector. The negative ohmmeter lead is at the collector. This works for NPN **or** PNP. Put a spot of paint or fingernail polish by the collector wire so you can identify it thereafter.

LEAKAGE BY OHMMETER

The tests you've already made tell you if a transistor is leaky or shorted. It's just a matter of interpreting.

When you've established the two low-resistance readings from the base, notice the readings in the reverse directions. If they're under 10K for either junction, there is too much leakage.

If you find low readings in both directions between any two leads, that junction is shorted. If a reading between two leads shows open both ways, even on the Rx100K scale, that junction is open.

A reading less than 10K from collector to emitter, in either direction, indicates too much leakage.

Two-step method for identifying a transistor type, and base, collector and emitter connections. You need only your ohmmeter, but the transistor should be out of the circuit.

OHMMETER TESTS

Step 1.—Find transistor lead that measures low R (150 ohms or less) to both other leads; that is the base lead.

If the ohmmeter lead on the base goes to the . . .	negative	positive
end of your ohmmeter battery, the transistor is . . .	PNP	NPN

Step 2.—Connect the ohmmeter for lowest R (above 10K) between the remaining transistor leads.

The negative ohmmeter lead identifies the collector.

ROSS HULL MEMORIAL VHF/UHF CONTEST, 1970-71

The Federal Contest Committee of the Wireless Institute of Australia invites all Australian and Overseas Amateurs and Short Wave Listeners to participate in this annual Contest which is held to perpetuate the memory of Ross Hull whose interest in v.h.f./u.h.f. did much to advance the art.

A Perpetual Trophy is awarded annually for competition between members of the W.I.A. in Australia and its Territories, inscribed with the name and life work of the man whom it honours. The name of the winning member of the W.I.A. each year is also inscribed on the Trophy. In addition, this member will receive a suitably inscribed certificate.

OBJECTS

Australian Amateurs will endeavour to contact as many other Amateurs in VK Call Areas and Foreign Call Areas under the following conditions.

DATE OF CONTEST

From 0001 hours E.A.S.T., 12th December, 1970, to 2359 hours E.A.S.T., 24th January, 1971.

DURATION

Any seven calendar days within the dates mentioned above, not necessarily consecutive. These periods are to be at the operator's convenience. A calendar day is from 0001 hours E.A.S.T. to 2359 hours E.A.S.T.

RULES

1. There are two divisions, one of 48 hours duration, and one for seven days. In the seven-day division, there are three sections:—
   (a) Transmitting, Open.
   (b) Transmitting, Phone.
   (c) Receiving, Open.

2. All Australian and Overseas Amateurs may enter for the Contest whether their stations are fixed, portable or mobile.

3. All Amateur v.h.f./u.h.f. bands may be used, but no cross-band operating is permitted. Operators are cautioned against operating transmitting equipment on more than one frequency at a time, particularly when passing cyphers. Cross-band operation to assist contest working is prohibited.

Such operation will be grounds for disqualification. Cross mode contacts will be permitted.

4. Amateurs may enter for any of the transmitting sections. The seven-day winner is not eligible for the 48-hour award.

5. Only one contact per band per station is allowed each calendar day.

6. Only one licensed Amateur is permitted to operate any one station under the owner's call sign. Should two or more operate any particular station, each will be considered a contestant and must submit a separate log under his own call sign.

7. Entrants must operate within the terms of their licences.

8. **Cyphers:** Before points may be claimed for a contact, serial numbers must be exchanged. The serial numbers of five or six figures will be made up of the RS (telephony) or RST (c.w.) report plus three figures, commencing in the range 001 to 999, for the first contact, and will then increase in value by one for each successive contact. When a contestant reaches 999 he will then commence again with 001.

9. **Entries must** be set out as shown in the example, using only one side of the paper. Entries must be post-marked not later than 8th February, 1971, and clearly marked "Ross Hull Contest" and addressed to Federal Contest Manager, Box N1002, G.P.O., Perth, W.A., 6001.

10. **Scoring** for all sections will be based on the attached table. Approx. distances to be shown in the log entry as shown in the example. Failure to make this entry will invalidate the particular claim. **Operation via active repeaters or translators is not allowed for scoring purposes.**

11. **Logs:** All logs shall be set out as in the example and in addition will carry a summary sheet showing the following information:

Name..........................Call Sign..................
Address......................Division.....................
.....................................Claimed Score..........
Operating Dates....................(7 cal. days)
Highest Score over a 48-hour period was.......................points.
Operating period:
from..........hrs. E.A.S.T. ....../....../7....
to..........hrs. E.A.S.T. ....../....../7....

Declaration: I hereby certify that I have operated in accordance with the conditions of my licence and abided by the Rules of the Contest.

Signed..................................
Date.....................................

12. Entrants not abiding by the Rules of this Contest will be disqualified.

13. The ruling of the Federal Contest Committee of the W.I.A. will be final. No dispute will be entered into.

14. **Awards:** Certificates will be awarded to the winners of each section in each VK and Overseas Call Area. The VK contestant who returns the highest score in the transmitting section and who is a financial member of the W.I.A., will have his name inscribed on the Trophy which will be held by his Division for the prescribed period. A Certificate will be awarded to the contestant who shall not be the Trophy winner, and who returns the highest scoring log covering a period of any 48 consecutive hours.

Also, Certificates will be awarded for operating in the Ross Hull Contest and breaking any Australian v.h.f./u.h.f. distance record.

SCORING TABLE

Distance in Miles	52 Mc.	144 Mc.	420 Mc.	576 Mc.	Higher
Up to 25 Miles	1	1	2	5	10
26 to 50 „	1	1	5	10	25
51 to 100 „	5	5	15	30	50
101 to 200 „	10	10	25	50	100
201 to 300 „	25	15	50	150	250
301 to 500 „	20	25	100	250	300
501 to 1000 „	10	35	200	300	350
1001 to 1500 „	15	100	250	350	400
1501 to 2500 „	25	125	300	450	500
2501 to 3500 „	35	200	400	500	600
3501 to 5000 „	50	300	450	550	650
5001 and over	100	400	500	600	700

RECEIVING SECTION

1. Short Wave Listeners in Australia and Overseas may enter for the Contest, but no transmitting station may enter.

2. Contest times and logging of stations on each band are as for the transmitting sections, however there is no 48 hour sub-section.

3. To count for points, logs will take the same form as for transmitting sections, but will omit the serial number received. Logs must show the call sign of the station heard (not the station worked), the serial number sent by it, and the call sign of the station being worked.

Scoring will be on the same basis as for transmitting stations, i.e. on the distance between the Listener's station and the station heard. See the examples given. It is not sufficient to log a station calling CQ.

4. A station heard may be logged only once per calendar day on each band for scoring purposes.

5. **Awards:** Certificates will be awarded to the highest scorer in VK and Overseas countries.

EXAMPLE OF TRANSMITTING LOG (Brisbane Station)

Date/Time E.A.S.T.	Band Mc.	Emission Power	Call Sign	RST/No. Sent	RST/No. Rcvd.	Dist. Miles	Points Claim.
24th Dec. 0100 E.A.S.T.	52	A3(a)	VK7ZAI	59001	59004	1110	15
0110 E.A.S.T.	52	A3(a)	VK4NG	58002	57051	330	20
0230 E.A.S.T.	144	A3	VK5ZK	56003	55043	990	35
0235 E.A.S.T.	144	A3	VK3ZJQ	45004	46021	850	35

EXAMPLE OF RECEIVING LOG (Perth S.w.l.)

Date/Time E.A.S.T.	Band Mc.	Call Heard	RST/No. Sent	Station Called	Dist. Miles	Points Claimed
2nd Jan. 1000 E.A.S.T.	52	VK5ZDX	59221	VK8KK	1330	15
1025 E.A.S.T.	52	VK2ZCF	58195	VK6ZAA	2040	25
1110 E.A.S.T.	432	VK6ZDS/6	57061	VK6LK/6	60	15
3rd Jan. 0500 E.A.S.T.	144	VK5ZHJ	44102	VK6ZCN	1330	100

QUEENSLAND WINS R.D.

From a previous three years of low percentage participation, VK4 jumped to 17%, to win this year's contest. While generally there was increase in State scores, only an increase of 2.3% participation was registered. Assisting VK7 this year was VK0LD's entry of 3,864 points, a magnificent effort of 644 contacts.

To Queensland go our congratulations and an invitation to all Divisions to increase their entries next R.D.

—Neil Penfold, F.C.M., for F.C.C.

DIVISIONAL TROPHY WINNER

QUEENSLAND

NEW SOUTH WALES

Phone

VK2OO	1102 Pts.	VK2AXJ	159 Pts.
2ATM	1089 ,,	2ACT	157 ,,
2BEC/T	876 ,,	2BMI	153 ,,
2RX	869 ,,	2AGW	151 ,,
2XT	810 ,,	2ABC	150 ,,
2ADA	742 ,,	2AMU	146 ,,
2AJY	710 ,,	2AEC	145 ,,
2RS	691 ,,	2AWW	144 ,,
2AXL	672 ,,	2AYE	137 ,,
2AHV	623 ,,	2MW	136 ,,
2ATT	618 ,,	2BMK	136 ,,
2AZY	594 ,,	2EW	114 ,,
2APP	585 ,,	2FM	110 ,,
2BDB	558 ,,	2UJ	109 ,,
2EU	528 ,,	2JP	108 ,,
2ADJ	520 ,,	2VA	95 ,,
2BDN	508 ,,	2AW	89 ,,
2APQ	481 ,,	2ALL	87 ,,
2AIA	460 ,,	2AU	86 ,,
2AGF	384 ,,	2AVT	83 ,,
2KM	376 ,,	2PF	81 ,,
2BIN	376 ,,	2AHH	81 ,,
2BFA	374 ,,	2ASJ	79 ,,
2AWN	365 ,,	2XD	78 ,,
2BNK	362 ,,	2BGG	78 ,,
2OH	349 ,,	2KR	75 ,,
2TS	346 ,,	2BAS	74 ,,
2AJL	335 ,,	2BJF	74 ,,
2VG	310 ,,	2EK	73 ,,
2ACZ	308 ,,	2GV	73 ,,
2BAZ	300 ,,	2ZQ	73 ,,
2BKM	297 ,,	2IJ	71 ,,
2BDC	275 ,,	2BKH	70 ,,
2WT	271 ,,	2AKV	67 ,,
2PN	269 ,,	2SG	61 ,,
2ZF	267 ,,	2BMV	54 ,,
2BMB	265 ,,	2CD	54 ,,
2BDH	259 ,,	2ATS	52 ,,
2AZE	253 ,,	2CK	51 ,,
2FC	238 ,,	2GS	49 ,,
2RU	232 ,,	2AKL	47 ,,
2AFA	230 ,,	2BNL	46 ,,
2ZB	214 ,,	2AHM	45 ,,
2BSH	205 ,,	2ANL	45 ,,
2AYF	203 ,,	2EY	41 ,,
2BEG	202 ,,	2AAW	36 ,,
2SJ	194 ,,	2RP	34 ,,
2ATA	188 ,,	2AC	31 ,,
2BD	182 ,,	2HQ/P	31 ,,
9TB/2	179 ,,	2AAH	29 ,,
2AEB	176 ,,	2AIM	27 ,,
2KA	161 ,,	2HM	25 ,,
2ADY	159 ,,	2ST	25 ,,

Phone (continued)

VK2BBO/P	25 Pts.	VK2BFD	12 Pts.
2EZ	22 ,,	2OM	9 ,,
2LA	20 ,,	2ZTD	6 ,,
2AUC	19 ,,	2VH	5 ,,
2EG	18 ,,	2AGV	5 ,,
2AHI	15 ,,	2ZPC	5 ,,

C.w.

VK2QL	473 Pts.	VK2RA	132 Pts.
2VN	400 ,,	2PQ	93 ,,
2ANZ	364 ,,	2ZC	77 ,,
2BF	359 ,,	2IC	72 ,,
2GR	347 ,,	2RJ	66 ,,
2BCC	310 ,,	2AXK	63 ,,
2EO	227 ,,	2JY	60 ,,
2GT	185 ,,	2GW	35 ,,
2NF	175 ,,	2IV	13 ,,
2YB	166 ,,	2AND	5 ,,
2ZO	149 ,,		

Open

VK2DO	1309 Pts.	VK2AGI	100 Pts.
2BO	1208 ,,	2AJQ	82 ,,
2RB	512 ,,	2OY	65 ,,
2DI	388 ,,	2AUD	63 ,,
2BBA	352 ,,	2CU	39 ,,
2AGH	294 ,,	2AL	29 ,,
2BMP	245 ,,	2BHO	26 ,,
2PU	221 ,,	2BMS	8 ,,
2PA	174 ,,		

VICTORIA

Phone

VK3VK	976 Pts.	VK3HZ	147 Pts.
3ADO	812 ,,	3AFI	144 ,,
3WW	752 ,,	3ACD	143 ,,
3AXV	669 ,,	3BCH	143 ,,
3ADW	653 ,,	3AER	142 ,,
3ABT	608 ,,	3ASI	139 ,,
3ASV	608 ,,	3APT	138 ,,
3SM	577 ,,	3AYF	135 ,,
3AOW	575 ,,	3EG	131 ,,
3BA	559 ,,	3AR	119 ,,
3EE	516 ,,	3BAX	113 ,,
3AIH	482 ,,	3BBB	108 ,,
3ATN	473 ,,	3AAM	106 ,,
3AZQ	466 ,,	3AH	102 ,,
3EF	461 ,,	3PY	101 ,,
3AMK	460 ,,	3KR	100 ,,
3BDQ	459 ,,	3AHG	89 ,,
3AMO	450 ,,	3PJ	73 ,,
3AKC	444 ,,	3TY	70 ,,
3YQ	385 ,,	3ARO	60 ,,
3AUN	335 ,,	3YO	57 ,,
3AQQ	321 ,,	3ZNJ	56 ,,
3ZJ	319 ,,	3AJP	54 ,,
3WQ	306 ,,	3VF	46 ,,
3TG	279 ,,	3AGH	44 ,,
3BDU	257 ,,	3ZQN	39 ,,
3ACR	248 ,,	3AIS	34 ,,
3XM	247 ,,	3YDK	34 ,,
3LV	243 ,,	3ZRL	34 ,,
3BAZ	232 ,,	3ABP	15 ,,
3RU	196 ,,	5TN/3	14 ,,
3YC	172 ,,	3ZTA	14 ,,
3AUC	160 ,,	3ARA	13 ,,

C.w.

VK3AUH	302 Pts.	VK3AKT	38 Pts.
3APN	249 ,,	3RN	35 ,,
3FC	195 ,,	3OF	31 ,,
3RJ	185 ,,	3BCI	22 ,,
3AMA	162 ,,		

Open

VK3QV	688 Pts.	VK3QK	257 Pts.
3AKS	639 ,,	3AXK	235 ,,
3JI	561 ,,	3ABA	171 ,,
3DG	558 ,,	3KC	143 ,,
3AFW	451 ,,	3ADP	56 ,,
3ARV	358 ,,	3TJ	37 ,,
3SL	352 ,,	3EZ	31 ,,
3AUJ	305 ,,		

QUEENSLAND

Phone

VK4ZQ	1239 Pts.	VK4QW	126 Pts.
4EQ	1141 ,,	4EV	121 ,,
4XY	1092 ,,	4QT	121 ,,
4DZ	1018 ,,	4EZ/P4	120 ,,
4FU	986 ,,	4FK	110 ,,
4FA/P	847 ,,	4JI	90 ,,
4KH	824 ,,	4CW	81 ,,
4LZ	814 ,,	4XZ	81 ,,
4ES	801 ,,	4SR	79 ,,
4IE	781 ,,	4RL	73 ,,
4LE	760 ,,	4TL	68 ,,
4VC	742 ,,	4RG	65 ,,
4UF	686 ,,	4GT	63 ,,
4AL	626 ,,	4NS	56 ,,
4GI	593 ,,	4WY	54 ,,
4DJ	588 ,,	4PU	50 ,,
4PX	579 ,,	4JM/P4	47 ,,
4QA	566 ,,	4XO	38 ,,
4FD	550 ,,	4FP	37 ,,
4MW	528 ,,	4ZBV	35 ,,
4NY	522 ,,	4JW	29 ,,
4NQ	464 ,,	4ZKP	28 ,,
4LB	453 ,,	4VS	27 ,,
4HW	448 ,,	4YB	27 ,,
4GP	420 ,,	4GS	26 ,,
4RF	352 ,,	4ZDC	26 ,,
4UC	322 ,,	4IO	23 ,,
4FX	302 ,,	4ZAL	21 ,,
4AR	270 ,,	4QF	20 ,,
4NP	266 ,,	4RW	19 ,,
4HB	258 ,,	4KS	17 ,,
4XX	221 ,,	4ZRG	16 ,,
4DV	210 ,,	4XI	12 ,,
4GG	210 ,,	4JJ/P4	11 ,,
4RT	203 ,,	4ZRT	9 ,,
4CZ	200 ,,	4CR	7 ,,
4OF	196 ,,	4ZP	7 ,,
4RO	184 ,,	4ZDG	7 ,,
4PJ	183 ,,	4ZEA	7 ,,
4ZW	177 ,,	4ZTL	7 ,,
4WT	171 ,,	4FZ	6 ,,
4FF	166 ,,	4ZFA	6 ,,
4DO	154 ,,	4PV	5 ,,
4AK	151 ,,	4ZR	5 ,,
4NO	151 ,,	4ZFF/T	5 ,,
4UG	147 ,,	4ZRS	5 ,,
4LX/P	144 ,,		

C.w.

VK4KX	454 Pts.	VK4ON	56 Pts.
4XW	380 ,,	4ZB	31 ,,
4LV	334 ,,	4FS	16 ,,
4XJ	72 ,,	4RZ	15 ,,
4KI	58 ,,		

Open

VK4LT	1145 Pts.	VK5CV/4	264 Pts.
4FH	815 ,,	4GZ	163 ,,
4UA	430 ,,	4BQ	17 ,,
4MY	301 ,,	4TC	14 ,,

SOUTH AUSTRALIA

Phone

VK5ZK	1358 Pts.	VK5TJ	393 Pts.
5QX	1297 ,,	5NT	376 ,,
5FT	1159 ,,	5LP	342 ,,
5BI	1147 ,,	5HM	338 ,,
5TY	1022 ,,	5ZD	332 ,,
5NN	964 ,,	5PH	314 ,,
5GV	949 ,,	5FL	306 ,,
5WV	861 ,,	5FD	301 ,,
5ZE	783 ,,	5DJ	249 ,,
5ZZ/T	737 ,,	5EF	204 ,,
5UJ	706 ,,	5LQ	184 ,,
5PX	702 ,,	5US	179 ,,
5SU	602 ,,	5RI	169 ,,
5CY	547 ,,	5ZU	164 ,,
5ST	543 ,,	5GG	163 ,,
5GM	540 ,,	5WI	159 ,,
5MF	529 ,,	5ZQ	158 ,,
5RR	494 ,,	5LZ	89 ,,
5GX	490 ,,	5EN	86 ,,
5LN	489 ,,	5TU	81 ,,
5UK	479 ,,	5DO	80 ,,

DETAILS OF DIVISIONAL SCORES

Division	Log Entry	Licensees	% Partici-pation	Average Top Six Logs	Total State Points	State Score
VK2+1+9	170	2,037	8.3	1,192	41,214	4,613
VK3	82	1,838	4.7	766	23,269	1,607
VK4+9	119	694	17	1,126	33,267	6,781
VK5+8	96	748	13	1,266	30,537	5,236
VK6+9	65	466	14	1,099	17,151	3,500
VK7+0	54	232	23.3	1,672	20,243	5,328

Phone (continued)

VK5UC	80 Pts.	VK5CL	28 Pts.
5UF	77 ,,	5MA	28 ,,
5LC	71 ,,	5ZEI	28 ,,
5SS	68 ,,	5ZDX	28 ,,
5ZKK	66 ,,	5ZIB	25 ,,
5XY	64 ,,	5OT	24 ,,
5VT	47 ,,	5ZLZ	21 ,,
5ZKJ	40 ,,	5LG	20 ,,
5TW	37 ,,	5DU	19 ,,
5GF	36 ,,	5ZWW	19 ,,
5FO	36 ,,	5DF	18 ,,
5ZHN	35 ,,	5CA	16 ,,
5GZ	33 ,,	5ZIS	8 ,,
5ZFJ	30 ,,		

C.w.

VK5MY	389 Pts.	VK5RK	44 Pts.
5OR	191 ,,	5HO	30 ,,
5BS	160 ,,	5AU	28 ,,
5MZ	106 ,,	5TL	20 ,,
5LD	101 ,,	5KU	15 ,,

Open

VK5EJ	899 Pts.	VK5DV	309 Pts.
5FM	644 ,,	5RG	224 ,,
5AX	532 ,,	5PL	180 ,,
5IF	399 ,,	5QH	49 ,,
5OH	394 ,,	5JC	44 ,,
5VW	382 ,,		

WESTERN AUSTRALIA

Phone

VK6ID	1373 Pts.	VK6AV	74 Pts.
6CT	1296 ,,	6ML	66 ,,
6BE	1058 ,,	6HT	59 ,,
6DR	991 ,,	6RG	58 ,,
6ZK	966 ,,	6SR	57 ,,
6WY	908 ,,	6WX	51 ,,
6DA	889 ,,	6IA	47 ,,
6AB	681 ,,	6TK	40 ,,
6KK	453 ,,	6OR	37 ,,
6AO	384 ,,	6TB	36 ,,
6JY	362 ,,	6ZDB	35 ,,
6SM	356 ,,	6MM	33 ,,
6LG	354 ,,	6CN	26 ,,
6VK	353 ,,	6RU	22 ,,
6KR	280 ,,	6XW	22 ,,
6TG	268 ,,	6PX	21 ,,
6KW	220 ,,	6ZGJ	18 ,,
6WL	197 ,,	6ZFF	15 ,,
6CF	192 ,,	6RJ	14 ,,
6MB	185 ,,	6AWI	14 ,,
6FH	168 ,,	6FN	14 ,,
6DC	148 ,,	6RX	13 ,,
6RC	128 ,,	6ZAY	10 ,,
6MO	122 ,,	6ZDK	10 ,,
6NS	81 ,,	6ZFD	10 ,,
6FG	78 ,,	6ZFL	6 ,,

C.w.

VK6AI	382 Pts.	VK6PL	259 Pts.
6WT	372 ,,	6AJ	127 ,,
6GI	260 ,,	6ZZ	13 ,,

Open

VK6MA	888 Pts.	VK6VB	247 Pts.
6JK	443 ,,	6NK	140 ,,
6HD	410 ,,	6CR	45 ,,
6RS	266 ,,		

TASMANIA

Phone

VK7AZ	1549 Pts.	VK7IH	132 Pts.
7TX	1160 ,,	7KK	129 ,,
7JV	1012 ,,	7SF	100 ,,
7MD	842 ,,	7VK	86 ,,
7WF	794 ,,	7LZ	74 ,,
7FM	586 ,,	7DJ	64 ,,
7ZX	539 ,,	7AB	45 ,,
7GC	460 ,,	7JV	45 ,,
7UX	443 ,,	7KH	41 ,,
7LS	416 ,,	7RX	39 ,,
7SR	335 ,,	7PD	35 ,,
7EJ	312 ,,	7JP	29 ,,
7MX	310 ,,	7ZRO	28 ,,
7BM	279 ,,	7ZIF	28 ,,
7KW	264 ,,	7ZMK	27 ,,
7AX	243 ,,	7CT	27 ,,
7CX	237 ,,	7ZAS	23 ,,
7EB	237 ,,	7ZJG	23 ,,
7IL	185 ,,	7MR	16 ,,
7PS	174 ,,	7BQ	8 ,,
7MG	169 ,,	7ZAK	7 ,,

C.w.

VK7CH	420 Pts.	VK7KB	135 Pts.
7LJ	309 ,,	7BJ	78 ,,
7RY	182 ,,		

Open

VK7KJ	1295 Pts.	VK7AL	316 Pts.
7SM	1153 ,,	7NC	147 ,,
7FB	670 ,,	7OM	85 ,,
7ZZ	428 ,,		

ANTARCTIC

VK0LD .. .. .. 3864 Pts.

AUST. CAPITAL TERRITORY

Phone

VK1JG	1333 Pts.	VK1ZMP	17 Pts.
1AR	668 ,,	1ZHG	7 ,,
1LF	472 ,,	1ML	6 ,,
1MF	71 ,,	1ZRH	6 ,,
1YR	33 ,,		

C.w.

VK1AG .. .. .. 5 Pts.

Open

VK1BC	1112 Pts.	VK1VK	263 Pts.
1VP	942 ,,	1DA	153 ,,
1AOP	627 ,,		

NORTHERN TERRITORY

Phone

VK8DI	664 Pts.	VK8AZ	199 Pts.
8ZQ	293 ,,		

C.w.

VK8HA .. .. .. 249 Pts.

Open

VK8KK	1616 Pts.	VK8JS	309 Pts.

PAPUA-NEW GUINEA AND TERRITORIES

Phone

VK9GA	1120 Pts.	VK9AG	215 Pts.
9RY	805 ,,	9JL	67 ,,
9BK	730 ,,	9NI	57 ,,
9XI	627 ,,	9BS	44 ,,
9AC	347 ,,	9KX	40 ,,

Open

VK9DM .. .. .. 660 Pts.

LISTENERS' SECTION

VK1	A. Blight	288 Pts.
VK2	S. Voran	1024 ,,
	J. Hillard, L2074	833 ,,
	P. Vernon, L2259	338 ,,
	K. Nad	281 ,,
	J. Snowdon	279 ,,
	D. Harrison	92 ,,
VK3	St. Paul's Radio Club	1044 ,,
	E. Tremayne	868 ,,
	A. Cox, L3308	675 ,,
	St. John's Radio Club	401 ,,
	D. Farquharson	373 ,,
	G. Lath	329 ,,
	W. Collyer	303 ,,
	I. Delves, L3440	247 ,,
	E. Trebilcock, L3042	194 ,,
	N. Hullet	128 ,,
VK4	M. Joyce, L4335	1110 ,,
	K. Cunningham, L4104	466 ,,
	B. Lenahan, L4182	382 ,,
	C. Paton, L4027	321 ,,
VK5	C. Hannaford, L5096	1277 ,,
	B. Chammen, L5118	773 ,,
	L. Earl, L5113	466 ,,
	R. Chester, L5087	87 ,,
	R. Edmeades, L5122	80 ,,
VK6	P. Drew, L6021	633 ,,
VK7	B. Livingston, L7047	1026 ,,
	J. Everett, L7043	1003 ,,
	I. Ellings, L7038	318 ,,

CONTEST CALENDAR

7th/8th Nov.: R.S.G.B. 7 MHz. Contest (Phone).

8th Nov.: International OK DX Contest (Phone and C.w.).

14th/15th Nov.: R.S.G.B. 1.8 MHz. Contest.

28th/29th Nov.: "CQ" W.W. DX C.w. Contest.

*12th Dec., 1970, to 24th Jan., 1971: Ross A. Hull V.H.F. Memorial Contest.

13th/14th Feb.: John M. Moyle Memorial National Field Day.

*N.B.—The dates as previously published in the Contest Calendar have been altered to those shown above.

THE RADIO HAM

If you should see upon the street
A little man with dipole feet,
A train of little pips behind,
He's a Radio Ham with a micro-mind.

His ears fan out like a radio beam,
His eyes give out with a neon gleam
And as he chews his molars oscillate
And his heart pumps blood at a video rate.

This man obtains with passing years
Infinite impedance between his ears
And finally succumbs to a heavy jolt
When he gets what he thinks is a microvolt.

The doc looks up from his microscope
And says to his nurse, behold this dope,
No trace of brain cells can I find
He's a Radio Ham with a micro-mind.

NEW CALL SIGNS

JUNE 1970

VK1YR—Canberra Y.M.C.A. Radio Club, Station: Corroboree Park Youth Centre, Ainsley; Postal: 16 Bannister Gardens, Manuka, 2603.
VK1ZPB—P. F. Bell, 39 Larakia St., Waramanga, 2611.
VK1ZWG—W. R. Godley, Station: 1 Gore St., Higgins; Postal: P.O. Box 15, Blamey Pl., Campbell, 2601.
VK2ADY—D. S. Hunt, 26 Mathews St., West Tamworth, 2340.
VK2ATY—L. W. A. Doolan, Station: Technical College, Newcastle; Postal: 130 Rae Cres., Kotara South, 2288.
VK2BHG—M. A. Harrison, 14 Market St., Rockdale, 2216.
VK2BRV—R. W. Allison, 98 Wardell Rd., Dulwich Hill, 2203.
VK2ZHR—T. F. Laidler, 131 Tudor St., Hamilton, 2303.
VK2ZHU—G. B. Cuthbert, 2 Nioka Ave., Keiraville, 2500.
VK2ZKI—B. R. Paterson, 30 Hyacinth St., Asquith, 2078.
VK2ZNA—M. J. Farrell, 4/183 Hopetoun Ave., Vaucluse, 2030.
VK2ZQA—R. J. Irving, 7 Lena Pl., Merrylands, 2160.
VK2ZSQ—R. J. Murray, 24 Mona St., Auburn, 2144.
VK2ZVK—V. H. Kaard, 53 Edna Ave., Merrylands, 2160.

VK3AFB—D. R. Riglar, 12 Palmerston Crt., Greensborough, 3088.
VK3AZK—W. D. D. Harwood, 85 South Valley, Rd., Highton, 3216.
VK3BDB—Geelong Grammar School Radio Club, Geelong Grammar School, Corio, 3215.
VK3BDE—LaTrobe University Physics Society, LaTrobe University, Bundoora, 3083.
VK3BDF—R. N. Field, 3 Mordon Crt., Nunawading, 3131.
VK3BDI—J. O. Williams, 25 Wentworth Ave., Sandringham, 3191.
VK3BDO—E. A. King-Smith, 311 Centre Rd., Bentleigh, 3204.
VK3BDP—J. E. Falkner, 17 Burgess St., Hawthorn, 3123.
VK3BDW—J. J. Wiseman, 20 Austral Ave., Ferntree Gully, 3156.
VK3BET—E. E. Tilley, 10 Tudor Crt., North Balwyn, 3104.
VK3BFL/T—H. H. Chittock, 11 Lt. Myers St., Geelong, 3220.
VK3CCX—M. C. Hooper, Portable/Mobile.
VK3YCV—N. R. Laidlaw, 43 Churchill Ave., Bendigo, 3550.
VK3YDG—G. J. Gill, 19 Dorset Rd., Croydon, 3136.
VK3YDH—A. N. Campbell, 20 Campbell St., Coburg, 3058.
VK3YDI—C. J. Jarvis, 9/105 Willesden Rd., Oakleigh, 3166.
VK3YDP—T. J. Alder, 26 Gramatan Ave., Beaumaris, 3193.
VK3YDQ—G. R. H. Vroland, "Carlscrona," Strathbogie, 3666.
VK3YDU—G. S. Pritchard, 32 Holland Rd., Blackburn South, 3130.
VK3YDV—K. W. Forbes, 7 Rodney St., Moorabbin, 3189.
VK3YDY—K. B. Lewis, "Kanda," Boes Rd., Hastings, 3915.
VK3YDZ—C. C. Maloney, Belgonia, Jersey Stud, Tongala, 3621.
VK3ZBN—R. J. Beevers, 11th St., Mildura, 3500.
VK3ZDD—M. J. Dow, 106 Bayview St., Williamstown, 3016.
VK3ZMD—J. F. Davis, Lot 10, Cousin Dr., Bayswater, 3153.

VK4NT—N. T. Casey, 33 Herberton St., Mareeba, 4880.
VK4SZ—Sunshine Coast Amateur Radio Club, Station: 3 Bambaroo Ave., Nambour, 4560; Postal: C/o. Radio Station 4NA, P.O. Box 279, Nambour, 4560.
VK4ZJ—R. J. Webb, 151 Alderley St., Toowoomba, 4350.
VK4CEB—E. F. Bacon, Station: Mobile; Postal: C/o. Newmarket Gardens Caravan Park, 199 Ashgrove Rd., Ashgrove, 4060.
VK4ZBH—R. R. Hartwig, Bona Vista Ave., Boonah, 4310.
VK4ZBR—R. S. Best, 12 Ardoyne Rd., Corinda, 4075.
VK4ZGZ/T—A. W. Reynolds, 159 The Esplanade, Cairns, 4870.
VK4ZIS—I. S. Graham, Station: Dakenbar Rd., Mt. Murchison; Postal: P.O. Box 507, Biloela, 4715.
VK4ZJA—C. J. Andrews, 151 Gailey Rd., Taringa East, 4068.
VK4ZKP—K. R. Pollock, 50 Vernon St., Nundah, 4012.
VK4ZRI—A. R. Woods, 22 Stanley St., Indooroopilly, 4068.
VK4ZSD—L. S. Dmitrieff, Station: Monto Rd., Thangool, 4716; Postal: P.O. Box 16, Thangool, 4716.

VK5QE—A. M. Parks, 10 Vine St., Morphett Vale, 5162.
VK5SU—J. W. K. Adams, O.T.C. (A) Staff Quarters, Lambeff St., Ceduna, 5690.
VK5SW—R. C. Norman, 6 The Parkway, Paradise, 5075.
VK5XI—B. Hannaford, 2/10 Broughton St., Glenside, 5065.
VK5ZFX/T—P. E. McMahon, 30 Creekview Dr., Redwood Park, 5097.
VK5ZPG—P. G. Whellum, 8 Coronation Pl., Port Lincoln, 5606.
VK5ZWB—W. B. Ricketts, Station: Section 85, Hundred of Yadnarie; Postal: P.O. Box 70, Cleve, 5640.
VK5ZXD—J. J. Piechnick, 15 Brigalow Ave., Seacombe Gardens, 5047.
VK6AB/T—K. C. Bicknell, 48 Sanderson St., Lesmurdie, 6076.
VK6AZ—G. P. Clifton, 13 Morley Dr., Morley, 6062.
VK6EK—A. E. King, 4 Marloo Rd., Greenmount, 6056.
VK6ZAT—R. A. Taylor, 118 Broome St., Highgate, 6000.
VK6ZEA—K. G. Burlinson, Station: Portable; Postal: C/o. B.H.P. Exploration Party, P.M.B. Kalgoorlie, 6430.
VK6ZEG—P. D. Morgan, 68 Clayton St., Bellevue, 6056.
VK7AR—H. Young, 1 Madden Pl., Devonport, 7310.
VK7IE—I. L. Eadie, 16A Stoke St., New Town, 7008.
VK7IH—W. I. Hooke, 302 Nelson Rd., Mt. Nelson, 7007.
VK8JS—J. F. Scougall, 13 Achilpa St., Alice Springs, 5750.
VK8ZRM—R. W. Maginness, 56 Gregory St., Parap, 5790.
VK9AG—A. G. Nunn, Station: Walaguna Rd., Rabaul, N.G.; Postal: P.O. Box 110, Rabaul, N.G.
VK9AV—E. V. Avenell, St. Michael's Estate Kieta, Bougainville, N.G.

CANCELLATIONS

VK2AQF—J. H. L. Field. Transferred to Vic.
VK2ATJ—L. P. Crowe. Not renewed.
VK2ZHR—P. Halpin. Not renewed.
VK2ZLF—L. W. A. Doolan. Now VK2ATY.
VK2ZPB—P. F. Bell. Now VK1ZPB.

VK3DJ—J. L. Gleeson. Not renewed.
VK3EW—E. C. Wheeler. Deceased.
VK3GX—P. R. Gibson. Deceased.
VK3HV—H. P. J. Trutmann. Not renewed.
VK3KX—R. Tandy. Deceased.
VK3NZ—D. E. Timms. Not renewed.
VK3AHI—J. Vogel. Not renewed.
VK3AJK—J. Spark. Not renewed.
VK3ASY—O. W. Guy. Not renewed.
VK3AWX—S. Davies. Not renewed.
VK3AXT—J. W. K. Adams. Now VK5SU.
VK3ZBE—J. A. Retchford. Not renewed.
VK3ZFQ—K. M. Cocking. Not renewed.
VK3ZIR—I. A. Rourke. Not renewed.
VK3ZKK—D. R. Riglar. Now VK3AFB.
VK3ZLA/T—H. H. Chittock. No wVK3BFL/T.
VK3ZLW—R. M. Stack. Not renewed.
VK3ZSR—A. C. Greening. Not renewed.
VK3ZTQ—C. Quain. Not renewed.
VK3ZTT—V. Avilov. Not renewed.
VK3ZYA—R. D. Young. Not renewed.

VK4VQ—E. V. Avenell. Now VK9AV.
VK4ZWJ—R. J. Webb. Now VK4ZJ.

VK5BZ—C. H. Baseby. Deceased.
VK5EN/T—A. R. E. Nitschke. Not renewed.
VK5ZWS—J. B. Sparrow. Deceased.

VK6ZCB/T—K. C. Bicknell. Now VK6AB/T.
VK6ZDV—A. E. King. Now VK6EK.

VK7ZBH—H. Young. Now VK7AR.
VK7ZED—I. L. Eadie. Now VK7IE.
VK7ZEK—W. I. Hooke. Now VK7IH.

VK8XI—B. Hannaford. Now VK5XI.

VK9DS—B. W. Smeaton. Not renewed.
VK9TB—E. W. Bastow. Not renewed.

MAILING OF QSL CARDS

Dear Sir,

Some time ago I decided to write to the P.M.G. Department on the question of postal charges and classification of QSL cards in unsealed envelopes for the purpose of direct QSL'ing.

I feel this may be of some interest to other Amateurs, who on occasions prefer to QSL direct, and who may have been in some doubt as to the relevant class and postal charges. This arose as I had received several cards in **unsealed** envelopes, marked "2nd class airmail" and on one occasion "printed matter only". Obviously there was a marked difference in postal charges.

Here then, is the reply from the P.M.G. Department.

—Peter P. Morrow, AX2BMP.

* * *

Postmaster-General's Dept.,
Sydney Mail Exchange,
N.S.W., 2012
3rd Sept., 1970

Dear Mr. Morrow,

First, may I apologise for the delay in replying to your letter of 12th August, 1970.

Following acceptance by the Universal Postal Union of a proposal designed to abolish commercial papers as a separate category, articles originally considered as commercial papers are now classified as letter post except the following, which may be transmitted at printed paper rates:

(a) Letter post items exchanged between pupils of schools provided they are sent through school principals;
(b) Pupils exercises in the original or with corrections;
(c) Manuscripts of works or for newspapers; and
(d) Musical scores or sheets of music in manuscript.

Consequently, there is no advantage in you sending your QSL cards in unsealed envelopes as they are not eligible for the cheaper rate of postage.

Postcards cannot be posted in an envelope or wrapper so there is no alternative here.

I cannot arbitrate, of course, upon the practices in other countries. However, Universal Postal Union ruling should impose similar treatment by all member countries.

Thank you for your interesting query and if you could arrange wider publicity for the official ruling, all to the good.

—J. Saunders, for Manager,
Sydney Mail Exchange.

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC

"HAM RADIO"

July 1970—

Inductively Tuned High Frequency Tank Circuits, W6SAI. High efficiency operation of parallel 3-1000Zs in the 14-54 MHz. region.

A Versatile Solid State Receiver, W1PLJ. Tunable i.f. on 80 metres with converters for the higher frequency bands.

Compact Frequency Counter, K4EEU. IC unit to count to 16 MHz. Lengthy and detailed article. Pictures and diagrams.

Low Drive Kilowatt Linear for Two Metres, K6HHN. Uses a 5CX1500A in a stripline circuit.

Computer Processing Slow Scan Television Pictures, W4UMF.

New Look in Teleprinters, W6JTT. Seems that the old electro-mechanical machines are giving way to all electronic systems which are considerably faster.

A Solid State R.F. Signal Generator, VE5FP. Describes a unit with attenuator covering the range 0.12 to 95 MHz.

Temperature Alarms for High Power Amplifiers, W2EEY. Since overheating is one of the first indications of a malfunction, such alarms will sound off or shut equipment down before serious damage occurs.

SCR Regulated Power Supplies, W4GQC. The theory and practice.

Microwave Hybrids and Couplers for Amateur Use, W2CTK. Describes how the s.h.f. boys can roll their own instead of paying lots of money for them.

August 1970—

Interdigital Pre-amplifier and Combline Bandpass Filter, W5KHT. High performance filter-pre-amplifier for v.h.f. receivers that features low cross modulation, low noise and excellent unwanted signal rejection.

Practical VXO Design, K6BIJ. An interesting approach to frequency stability in oscillator circuits.

Divide by Ten Frequency Scaler, K4EEU. Describes an accessory that will increase the range of your frequency counter by a factor of ten. With this unit and the counter described in "H.R." July 1970 you can count cycles to over 100 MHz.

Computer Aided Circuit Analysis, K1ORV. A powerful tool that eliminates trial and error in circuit design.

A Tunable Audio Filter for C.W., WA1JSM. Using two Raytheon RM709 linear integrated operational amplifiers, the 3 dB. bandwidth is about 140 Hz.

A VFO for Solid State Transmitters, W3QBO. If you are tired of being rockbound, here is a neat v.f.o. featuring the Vackar oscillator. Uses two MPF102 FETs and an HEP55 bipolar transistor.

An Improved Six Metre Converter, K1BQT. A new approach to v.h.f. converters using FETs and a tunable local oscillator.

Improving the Intelligibility of Communications Receivers, WA5RAQ. This author points out that sometimes the amplifier is better than the reproducer and that improvements can be made simply by improving this fellow.

Quad Antenna Design Parameters, K6OPZ. The performance one obtains from any antenna is almost always determined by the final adjustments made upon the unit. This author does not agree with all that has been written. Who is right?

Modular Modules, W9SEK. Mother and daughter printed circuit boards are used to increase IC counter circuit versatility.

"RADIO COMMUNICATION"

June 1970—

This month's issue of the journal of the Radio Society of Great Britain contains a number of interesting articles.

A Keyer for GB3VHF, G3MNQ. An electronic unit with only one moving part, the keying relay. Ideal for keying beacon stations.

Decibels down the Drain, G8ON. This author points out that readings obtained on the usual type of s.w.r. meter are often optimistic and even though you may have a low s.w.r. it is rarely 1.1:1 or less.

A Quarter Wavelength Vertical Aerial, by G3SAA. The Britisher is often said to be one who hides his light under a bushel, or to put it another way, is self effacing. This Amateur hides his vertical alongside the brickwork of his house.

Technical Topics, G3VA. Deals with "The Double Balanced Mixer," "FET Mixers," "Balanced FET converter," "All-Transistor Transmitters" including some mention of VK7RG, "Amateur Radio" and "The Australian EEB," cathode modulation using transistors is also covered in some detail.

Put a Transistor in Your Cathode (2), G3SBA continues his article on getting something for almost nothing. Of course this technique has been used before to power the low power front-end stages of a communications receiver undergoing modification to solid state on a stage by stage basis.

T.V.I. Tips, G3JGO. For those plagued by the stuff.

Unfolding a Hopeful Future, G5UM. Sixteenth V.h.f./U.h.f. Convention report.

July 1970—

A 160 M. Linear using High Voltage Transistors, G3UFW. Describes some of the possible tricks for increasing power to transistor rigs.

A Narrow Band F.M. Exciter for the V.H.F. Bands, G3ISZ.

Put a Transistor in Your Cathode (3), G3SBA. A hybrid driver stage for an s.s.b. transmitter.

Technical Topics, G3VA. This is a monthly feature conducted by Pat Hawker which provides a precis of a number of articles which have appeared in the various journals, not necessarily Amateur, but which appears to be of interest to a goodly number of the fraternity.

Oscillator Noise and Its Effect on Receiver Performance, G3JGO. With a title like that, what else can one say?

Solid State Modules, 2 M. Converter, G3GGK and G3EDD. Noise factor better than 2 dB. Gain 35 dB. D.c. supply 12-18 volts, i.f's available: 4-6 or 28-30 MHz.

The Decibel, G8BEO. The newcomer to electronics usually has difficulty in understanding the dB. It is explained here once again for those who need it.

"RADIO ZS"

June 1970—

A Parenthetical Fairy Tale, W1JBQ.

Electronic Time Meter for the Darkroom, by ZS1CA.

About Making S.w.l. Reports, ZS1RR.

Six Metre Conversion of the B-44 Transmitter Receiver, ZS1IM. This unit originallly operated in the range 60-95 MHz. on three pre-set crystal controlled channels.

Improvements for the FL100B S.S.B. Transmitter, ZS1CK. This author states that his unit was very unstable and he found it nearly impossible to improve the in-built v.f.o. without major surgery. He therefore built an outboard v.f.o. and made certain other mods to improve the performance.

July 1970—

Some Linear Considerations, ZS5HF. A discussion of what happens if a "linear" is not and how to make it so.

Q-Code. Tells you what these three letter groups mean.

The G3NUG Triband Single Feed Quad. Dimensioned sketches only.

All Hams Are Braggarts, ZS1ACD. Perhaps we are all braggarts in certain directions.

F.H.C. The Flying Ham Club.

"73"

July 1970—

An Improved Method for the Transmission of Colour Information by Slow Scan Television, W4UMF. Those who are interested in colour t.v. should follow up on this one for themselves.

World-Wide I.T.U. Prefix/Call Area List, W1SWX. What can I say!

The Super Auto-Patch, K6MVH. When disaster strikes there is no substitute for rapid traffic handling. This facilitates person to person contact.

How to Build a Keyer (and retain your appliance operator status), W9KXJ. VKs would probably find that 2000 type relays provided the necessary parts.

A Two-Channel Search and Lock for F.M. Receivers, W3DTN. This simple gadget turns a two-channel rig into an automatic scanning type and provides the added capability of locking on a channel where activity is sensed.

A Look at Allied's Portable F.M. Receivers, K9STH/5. These Japanese units were made for the mobile bands but one covers 2 metres. They are considered to be good value although not really hot.

450 MHz. Mighty Mite, K9VXL. Maybe one should say the littlest transmitter.

Cheaper Six Metre Half Gallon, K1CLL runs 500 watts to a pair of 811As.

High Performance Power Supply using an IC Regulator, K0ECF/7. Move over voltage variation.

Latham Island DX-pedition, 5H3LV and 5H3KJ. Good hamming holiday.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.

Closing date for copy 30th of month.
All Times in E.S.T.

AMATEUR BAND BEACONS

VK4	144.390	VK4VV, 107m. W. of Brisbane.
VK5	53.000	VK5VF, Mt. Lofty.
	144.800	VK5VF, Mt. Lofty.
VK6	52.006	VK6VF, Tuart Hill.
	52.900	VK6TS, Carnarvon.
	144.500	VK6VE, Mt. Barker.
	145.000	VK6VF, Tuart Hill.
	435.000	VK6VF (on by arrangement).
VK7	144.900	VK7VF, Devonport.
VK9	146.000	VK9XI, Christmas Island.
ZL3	145.000	ZL3VHF, Christchurch.
JA	51.995	JA1IGY, Japan.
W	50.091	WB6KAP, U.S.A.

You will note there is a new addition to the beacon list. Per favour of the VK6 V.h.f. Group News Bulletin, advice is noted that VK9XI operates on 146.000 MHz. as a c.w. beacon, this should surely be something for the VK6 boys to strive to hear and it is to be hoped there is some activity on 2 metres around the Christmas Islands to make any of their efforts worth while.

An interesting letter this month from Kerry Adams, AX5SU, who is located at the O.T.C. Satellite Station, Seduna, on the far west coast of S.A., about 340 air miles from Adelaide. Kerry reports that at the installation there are four Amateurs, two being keen on v.h.f., namely, AX2BRG/5 and himself. His present set-up is an FT200 for h.f. to TH3JR at 40 feet. An FV650 is on order and in readiness the FT200 has been equipped with extra 10 metre crystals for tunable i.f. purposes. The 6 metre antenna is 4 elements at 45 feet, while 10 element 2 metre beam is mounted at 48 feet, fed from an "old faithful" 20 watt a.m. transmitter. Some problems have existed with high winds flapping the telescopic mast with all that weight up top, but Kerry is keenly looking forward to the forthcoming DX season. 2 metre operating frequencies are 144.200, 144.400 and 144.900 MHz., the last being most used. (Might suggest you use one of the lower two for best results, most Amateurs' converters and beams are optimum in lower portion of band.—5LP) He also plans using QQE06/40, etc., transverting from FT200.

Kerry reports that on some warmer nights he has already run tone for hours on end with m.c.w. identification beamed on Adelaide on 2 metres with no results yet. However, by adjusting his converter to 136 MHz., has been successful in receiving signals from many satellites, so the receiving gear seems well in order. 6 metres into Adelaide may not be easy during the DX season except for very short skip, but interstate Amateurs might note that Kerry should be operating on 6 metres this summer. Former call sign VK3AXT for about 13 years. Thanks for the info OM.

Bob VK3AOT advises the bands have been quiet for some time now, although Lou VK-3ZYD has been having successful t.v. transmissions on 432 MHz., using home-brew solid state t.v. camera, 2-1 interlaced scanning, transmitter grid modulated QQE06/40, receiver uses VK3 432 MHz. converter.

Bob passes on the sad news that a call from Phil VK2YS in Wagga, N.S.W., indicates virtually no activity on 2 metres a.m. in the western N.S.W. area. A 52.525 MHz. f.m. net has been started there.

The VK3 Field Day on 27th Sept. attracted 7 portable stations on bands between 6 and 432, but due to poor conditions no contacts were made with VK5 stations. Here in VK5 there was considerably more portable activity than usual, but again under quite foul conditions. Heavy and widespread rain fell over most of the likely operating areas all day on the Saturday (26th), all night and on Sunday intermittent rain, fog and generally shocking conditions. However, there was a lot of fun and one group under the call sign of VK5ZDX/5 was noted with more than 100 contacts for the day, a good score under the conditions. John VK5QZ and myself did not get under way until the afternoon session, but ran up 40 contacts in 3 hours using 6, 2 and 432, so this will give some idea of the type of activity under such poor conditions.

The v.h.f. world now awaits with interest to see what becomes of activity in Mt. Gambier following the successful passing of the last c.w. examination by Colin VK5ZKR, Garry VK-5ZGR and Chris VK5ZFA. Such happenings are an acid test for the degree of indoctrination of v.h.f. interest. It would certainly be a tragedy for v.h.f. should they desert the bands; we all hope not. However, congratulations to you all.

MEET MR. MOONBOUNCE

The following is extracted from "Break-In," the official publication of N.Z.A.R.T., for which we thank them, the item being of general interest to v.h.f. operators.

"John Morgan, ZL1AZR, has been moonbouncing since Dec. 1964. His efforts have received international recognition and he is amongst the leaders of the exponents of this, the rarest of all DX. John is certainly not 'resting on his laurels'. Indeed, he is presently scheduling Canada and France in the bottom 10 KHz. of two metres! Six years of patient and skilful effort have gone into his work . . .

"At this time of writing, John has worked Sweden, SM7BAE, no less than 21 times! (This must surely be some sort of record!) and the U.S.A. (Iowa), K0MQS. He has been heard by VK3ATN, many Ws and VE7BQH, and on the local scene, ZL1MO. But the most tantalising one is that he has had partial two-way contacts with Mike Staal, K6MYC, for three years without ever making it a 'real' contact. Tenacity **must** pay off here.

"Here's two months of activity: May 1, 2, 14, 15 and 30. Schedules with SM7BAE and contacts **every** schedule! Signals on 15th were so good that John asked Kjell to go s.s.b. and was able to copy S2.

"June 10: Sixth consecutive QSO with SM-7BAE. Just missed with K6MYC. John was hearing him well, but Mike could not quite get a signal report from John. June 12: Same again with K6MYC, but this time John could not get the signal report. Heard VE7BQH quite well, but it looks as if he needs 1 or 2 dB. more at his end (he is using 80 element collinear—needs a 160 element—Ed.) Quite a record, isn't it?"

(Subsequent to this being prepared, John advised David ZL4PG, "Break-In" V.h.f. Editor, of the following.)

"Just a quick note to advise that the first N.Z.-California 2 metre contact has been achieved. Between 0300 and 0400 July 7, 1970, GMT, K6MYC in San Jose, California, and I (ZL-1AZR) made a two-way QSO on 144.004/5 via Moonbounce. This contact gives me an enormous amount of pleasure because Mike has been a great source of encouragement to me over the past few years in my MB efforts—also it marks the end of a marathon endurance effort because I first heard K6MYC in 1965/66 and he has heard me since 1967! We have another sked tomorrow and VE7BQH is also taking part again for he was copying my signals pretty well during today's sked for about 20 minutes, so with a little luck I may make the first N.Z.-Canada 2 metre QSO. Other skeds are being organised with F9FT and F8DO, but mutual moon time with France is pretty limited."

The Station.—"The station at ZL1AZR consists of a transmitter primary frequency control of a 14 MHz. FET crystal oscillator which is variable from 14.007 to 14.000 MHz. This is fed into a simple transverter and mixed with a 130 MHz. oscillator chain to produce 144.000 to 144.007 MHz. About every four months, the frequency has drifted up about 400 to 500 Hz., and is then re-adjusted. Frequency variation during a 2-hour schedule is less than 30 Hz. The transverter is run in a linear fashion to allow 14 MHz. s.s.b. to be fed in if desired. The transverter output stage is a 5894 (QQE-06/40) throttled down to about 7 to 8 watts to drive the p.a., which is a pair of 4CX250Rs, to a kw. input (class C) and, of course, very much less in class AB1 operation.

"As John says, it is very difficult to obtain perfect frequency stability when keying a large v.h.f. transmitter, but believe it or not, John keys the d.c. (battery) supply lead to the 14 MHz. crystal oscillator only. He found this to be the only method which gave him perfectly chirp-less keying. John mentions that a moment's thought will show that even a keying change of 15 to 20 Hz. during keying will put your signal right out of the bandpass of an audio filter. A chirp as small as this is not even noticed in a 500 Hz. wide filter at normal b.f.o. pitch.

"The ZL1AZR receiver tunable oscillator is an IGFET v.f.o. with a 7 KHz. tuning range around 5.5 MHz. The total receiver tuning range is from 144.000 to 144.007 at a bandspread of 1 KHz. to two inches of dial travel! This oscillator, based on a circuit appearing in 'RCA Ham Tips' some 3 or 4 years ago, is capable of extremely low drift operation after some weeks of getting the temperature compensation right.

"John adds: 'However, the same could be said of any v.f.o.! I am sure that the circuit used has little bearing on the stability obtainable unless one has the patience to perservere with the temperature characteristics of the gadget **in your particular environment.**'

"Changing the subject somewhat, John continues: 'Here is a point you may find interesting. Careful measurement and recording of signals from SM7BAE show ground reflection, gain peaking here at an elevation of 4.5, 9 and 13.5 degrees with maximum gain occurring at 9 degrees elevation. Calculated minimum radiation angle for my low height array is 4 to 5 degrees, which, by happy coincidence, gives addition of direct and ground reflected signals at low multiples of this figure. There may be theoretical holes in this idea, but signal strengths from SM7BAE, recorded over the past year or two, agree pretty well. However, there have been times when good signals have been received (a) after local moonset by up to four minutes; (b) at elevation angles and bearings where my iron roofed house is obstructing the antenna's view of the moon almost completely!'

"John adds a final comment to those contemplating EME or MS work. 'I have found during recent skeds that better weak signals results have been obtained since changing the i.f. bandwidth from 500 Hz. to 2-3 KHz. When used in conjunction with a narrow band tunable audio filter, the wider i.f. seems to give a more even noise spectrum—apparently the narrow 500 Hz. filter maintains a slight ringing tendency on noise pulses and, of course, the following audio filter magnifies the result to the stage where the theoretical signal-to-noise benefits of reduced bandwidth are not realised in practice'."

So there you have it. ZL1AZR is now reaping his just rewards for patience, skill and untiring effort, and so by doing, continues to show there are some still prepared to construct equipment capable of producing results undreamed of perhaps a decade or so ago. Congratulations.

NEWS FROM THE NORTH

Doug VK8KK in Darwin sends an interesting letter of happenings to the north of Australia. He reports conditions have been little short of excellent with five countries being available on 6 metres most nights. The 52 MHz. back-up net on 14130 KHz. is working perfectly with everyone using this to great advantage. Those regularly heard being JA1LZK, JA1MRS, KA-2EB, HL9WI, VS6DA, VS6BF, VK9ES, VK9BB, VK4RO, VK2ASZ, VK8AU, VK9DJ, VK8KK, KR6RS to name a few. Doug says there are two main interests: (1) nightly "pipe-line" Darwin to New Guinea on 6 metres, and such strong ionisation that it allows David VK8AU in Tennant Creek and Doug to work back scatter for hours on end, and (2) worked Ros VK4RO at Ayr on 19th Sept. at 9 plus during the period of a forward scatter contact with VK8AU. Present procedure is to monitor 14130, ask if anyone is listening 6 metres, always seems to be a reply, and away they go!

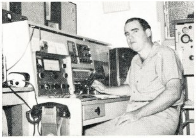
Doug wants it widely known that he and David will both have automatic keyers in operation for the next meteor showers, the best being Geminids on 13th and 14th Dec. He would like as many stations as possible to come on about that time. October "A.R." sets out details in the v.h.f. notes of techniques to aid in making contacts. Study these.

Continuing with Doug's news, he reports that HL9WI runs his beacon on 50.100 MHz. up to about 1930 daily and all day, then changes frequency to 52.010 MHz. from then on. It is c.w. and s.s.b. and has a 15 second break-in period as announced. Doug would also like to know if there is any way of stirring DU and KH6 prefixes to get on 6 metres, there are plenty of them but seemingly little interest.

It is interesting to note the constancy with which Doug is able to contact David VK8AU, distance 540 miles, about 30 per cent. Q5 copy s.s.b./c.w.; 50 per cent. on noise or frustratingly unreadable, but surely detectable, and 20 per cent. below the noise. And meteors add to this for plenty of signals not counted above. His concluding note just seems to round off the situation of making us even more envious down here: On 28th Sept. he worked VK9GA (Noel) in Kaviang, New Ireland, 5 x 9 with 2 x s.s.b., and VS6BF (Bob) in Hong Kong split frequency 50.1 to 52.1, with Bob running 1.5 watts, contact 2 x c.w.! So down South we here may yet have a good year, here's hoping.

And that's just where these notes finish, there is no more news! Thought for the month: "If I were a godfather wishing a gift on a child, it would be that he should always be more interested in other people than in himself. That's a real gift!" 73, Eric VK5LP, the Voice in the Hills.

MEET THE OTHER MAN

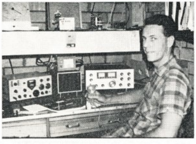


Ross VK4RO

Meet Ross VK4RO, ex-VK4ZRV, of Ayr, 50 miles south of Townsville in North Queensland. First licensed in 1960, Ross operates in the 52 and 144 MHz. bands plus 10 through to 80 metres. On 52 MHz. he runs 400 watts p.e.p. s.s.b. using a 3-400Z in the final to a 4 element Yagi up 70 feet. The converter and tunable i.f. together are an SB-110A Heathkit, and he has worked VK1, 2, 3, 4, 5, 6, 7, 8, 9 and ZL4. (This is a surprise, most others have worked ZL1, 2 and 3 but no 4!) In addition he has worked all JA1 to JA0 inclusive and KR6.

On 144 MHz. Ross runs 10 watts to a TT15 with a 10 element Yagi up 40 feet, with an R.T.V. & H. converter to a KW77. He has not worked out of VK4 so far, and being about 900 to 1,000 miles from the main centre of 2 metre activity, makes it hard to do very much. His location is 13 feet above sea level. However, when the occasion permits or conditions demand, Ross is able to go out portable and has a site about 10 miles south of Ayr 600 feet high, but the last 50 feet needs gear to be carried! Power is from a 300 watt a.c. alternator and uses the SB-110A equipment on 6 metres and 1936 transmitter and converter on 2 metres, 5 element beam for 6, 10 element for 2 metres.

Ross is a member of the W.I.A., President of Townsville Radio Club for two years, and is an electrician by occupation. He has recently returned from a trip to Japan, Taiwan and Hong Kong with his brother Dale VK4ZDG and Peter VK4ZPL. They met about six JA1 6 metre operators and were given a "royal" welcome. Thoughts for future activity include plans for 400 watts p.e.p. s.s.b. on 2 metres, then on to 2 metres f.m. mobile, and the distant future 432 MHz.



Doug VK8KK

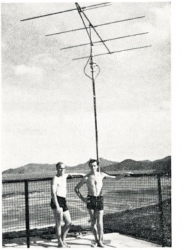
Now we go to a fresh State and get some news from Doug. McArthur, of 9 Bulbul St., Ludmilla, Darwin, under the call sign of VK8KK, previously VK5KK. First licensed in 1958, Doug has been a very keen v.h.f. type ever since. He was a former President of the VK5 V.h.f. Group, and when his work as a shift supervising technician with the Radio Australia booster station took him to Darwin, plenty of radio gear went with him or has been sent up since. He made his presence known by spending some time as President of the Darwin Radio Club. His location is 400 feet above sea level and he holds certificates for V.H.F.C.C. and W.A.V.K. awards obtained while in VK5. Other interesting details re VK8KK were given in the V.h.f. Notes for October. Taken overall, Doug must lead a very busy life, so I am sure we all wish him well in the cause of Amateur Radio.

Geoff VS6DA

Geoff VS6DA photographed at his QTH in the New Territories of Hong Kong, holding a QSL from Doug VK8KK which records their 6 metre two-way—believed to be the first ever Hong Kong/Darwin—contact on 50 MHz.

The QSO took place on 2nd June, 1970, at 1145 GMT, and was perfect 5 x 9 copy at both ends. VS6DA's 6 metre gear is on the left of the photo and is the Yaesu FTV650, in conjunction with the FLDX400. The beam is a 5 element wide spaced by Maspro, whilst Doug uses a home-brew transverter into an FTDX400 with a 9 element Yagi.

Geoff lives permanently in Hong Kong and is a pilot for an airline based there. He flies into Perth, W.A., from time to time and enjoys eyeballing with the VK6s. You will find him on 14.180 MHz. when he's not on duty, ready to try for more VK DX on 6 metres.



John VK8ZCW with Geoff VS6DA

John VK8ZCW (on the left) with Geoff VS6DA at his QTH overlooking the sea in the New Territories of Hong Kong. The 6 metre antenna shown is the one used in the recent two-way QSO between Darwin (VK8KK) and Hong Kong. John was able to call on Geoff recently whilst vacationing in the Far East and deliver personally the 6 metre QSL card from VK8KK.

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

Band conditions have appeared to be much better since the last notes, with some increased activity on 10. Strong signals have been noted on all bands, with some interesting openings at odd hours. Unfortunately I have no sunspot counts to hand this month.

Recently under the awards section, I had an item in reference to the WA5HUR "Golden Microphone Award," issued monthly to a selected manager. I am pleased to note that the award for September was won by our old friend George Studd, ZL2AFZ, who is well known in the DX field as manager for the recent operations from the ZL "countries". Congratulations George.

Roy ZM1AAT/K advises that he will be going QRT around mid-October, after a very successful period of operation, in which time he had made over 20,000 contacts.

George ZM2AFZ, who is manager for Harold AX0LD, advises that activity from there has been curtailed due to official commitments on the other side of the island, also there has been some delay in clearing logs due to bad conditions, and Harold's regular absence from the transmitting site. He is due to return to New Zealand at the end of December, but will make as many contacts as possible in the meantime. Further to the above notes from George, I note that Harold was back on the band yesterday (Sept. 28) putting a terrific signal into VK2.

ZL4JF/A is the call allocated to Bruce during his period of activity from Campbell Island. Frequencies are 29035, 14035, 21035, 7015 and 3535 c.w., also 28550, 14250, 14215, 21350, 7090, 3690, and 3825 s.s.b., answer as directed. QSLs to ZL2AFZ. Also on Campbell Is. for a year is Lindsay Barker, using the call ZM4OL/A, and our good friend Jock ZL2GX will be handling his QSL chores.

Recent activity of AZ3ABW/LH, has QSL manager K2YLM, Earl Smith, 183 Broad St., Eatontown, N.J., 07724.

There has been a slight flutter from AC3 and 5 this month. Larry K2IXP was expected to be on from AC5 during September, also from AC3, however the reports are conflicting. If you did work or hear him during that period, send your QSL to W2MMC. Meanwhile, Reg VE7IG anticipates being on from AC3PT and 9N1MM early in October.

Albania is in the news again, two recent operations having been reported. When reports were all sorted out, it appeared that it was one actual operation, by DL7FT and DL7LV using the call ZA2RPS. It took place from Sept. 14-17, everything going according to plan, and over 3,000 QSOs were made. QSL arrangements are as follows: For two-way contacts, send cards to DL7FT, Frank Turek, Petunierweg 99 (1), Berlin 47, Germany, and for S.w.l's to DL7LV. I would emphasise that during this period, several contacts were made with a station signing DL7FT/ZA using c.w., however this chap was a pirate.

The current crop of stations with ZK calls is attracting a lot of interest, and a few of them can be found most evenings. One is ZK-1MA, Tuatai, who is resident at Manihiki and spends quite a bit of time in net operation with other ZKs. He prefers to operate on 7060 c.w., is not used to pile-ups, has KH6SP for MC during such happenings, and has Ed KH-6GLU as QSL manager. ZK1AJ operated from Manihiki for a period of two days, but had only a few contacts, these being with PACNET members. Over on Niue Wally ZK2AF is busy. He is usually found in the Pacific Net, will be there for a year, and suggests you QSL direct to him, W. Christie, C/o. Education Dept., Niue Is., Sth. Pacific, via N.Z. ZK1AA is on regularly from Cook Is.

F9JS, Jean-Charles Sacotte, 180 Avenue de Choisy, 75 Paris 13, France, is the correct address for QSLs going to F9JS, C3IBD and 3A0EU. Two other C3I's are active, they are C3IDJ who is WB6CAB and C3IDG whose cards go to G3CDK. WB6CAB had been active from Jersey and Guernsey as GC5ASS for four days prior to his Andorra operation.

Al CR5SP is active daily on 14175 s.s.b., working to a list taken by CR6LF every day between 0530 and 0700. Also QRV on 21250-350 s.s.b. every week-end, but the time given, 1700z is a bit early for VK. QSL to Box 97, Sao Thome, Portuguese West Africa.

Edgar G3BID was due on from LX over the last weeks of Sept. and as he also holds calls F0RT, ON8ID and PA9BID, it was expected that he would show up from there also. There has been quite a bit of activity from LX this year, LX2CQ in the WAE contest asked for cards to DK1YK, LX3PTT is a PO station active on 80 and 40 metres only, whilst I note a very strong signal from LX1BJ recently on 20 c.w. at 0700z calling CQ with no takers.

We must not forget the prefix hunters, and as usual there are a few in the news sheets this month. CM3LN, is Box 6, San Antonio de Los Banos, Cuba. FO0TC QSLs via W9CTY, FO0TB goes via W6OFF. 4J1CR goes to UA-3CR, Box N88, Moscow. FP0CA goes to K2OLD, but like most of these odd prefixes, the news sheets don't give a reason for their existence.

New members for the ISWL, contact with whom will count for the Monitor Award are: DK2BI, DL4WJ, G8CWS, XE1AE, VE1QJ, WA-0PVW, GM3ZCQ, W0CDL, EL2Y, I1PAI, KP4AN, DL4QQ, VE3CDZ, W7QYA. QSLs for any of the above can go to the ISWL Bureau, C/o. Eric Chilvers, 1 Grove Rd., Lydney, GL155JE Glos., England.

Ron 9G1GT has been active for some time now and puts a good signal into this country. His QSL info is Ron Hockey, International Labour Office, U.N. Development Programme, Box 1423, Accra, Ghana.

Jack AX3AXQ, from down in Tatura, has been trying out his new s.s.b. rig and has some good contacts in the log. Some of his catches are VR5LT, Sundays about 0800z, QSL via VK6WT who gives a very prompt service; HS4ADB on 14155 at 1000z, QSL to K0OKB; Jack YN2TJH, Box 18, Granada, Nicaragua; Vic. UA1KAE down in the USSR Antarctica, QSL to Box 88, Moscow. Jack also mentions the WAC 5/9 Award, for phone you need one confirmation from each continent, for c.w. you need three with 599 reports from each continent, except if on 40 or 80. Send to Tom Harmon, W0IUB, 1629 Pleasantview, Wichita 3, Kansas, with seven IRCs.

It is almost certain that Joaquin CE3ZN and Gus will have a trip to San Felix and Juan Fernandez during this coming November. Details are not available as yet, but if they come to hand I will pass them on for the broadcasts. Jaoquin makes a special request that all chaps who want a QSL from CE9AT send a self addressed envelope with their card. He won't say no to an IRC as well.

For over 20 years HC8 Galapagos has eluded me. May have another chance to get hold of this much publicised country at last, as there are three active stations there at the time of writing, according to the Long Island DX Assn. HC8FN, HC8FS and HC8GS, the latter has been on 14220 at 0040z looking for contacts, and says QSL to HK3WO.

Back to Tatura for a moment to note a letter from Tom AX3BBC who had been having a look at the DX whilst recovering from the 'flu. Using a FT200 and dipole up 20 ft., he made some good contacts, among them MIB, QSL to WA3HUP, FO0TC on Tahiti (QSL to W9CTY), CR7IC, YB9, FB8, YU, SP, XE2, ON4, EA and UC2BF. Tom also operates the Shepparton South High School Club station AX3BBY.

Whilst on the subject of letters received, a word of acknowledgment and thanks to Jock AX1LF for taking the trouble to drop me a note re the ZM4OL/A operation from Auckland Island.

I would also like to acknowledge a tape from Steve Ruediger over in VK5, which gives portion of transmissions from stations in CO, HA, YO, TI, 3B8, VQ9A/F, CN8, VP2, 6Y5, AP5, 9Y4, IS1, KW6, HS0, GW, EP2, JT1, UP2, FG7, ZK2, AC3 and many others. Who said the bands are dead?

The locality of stations in the USSR are sometimes a little difficult to pinpoint, but I have here a list of their calls and associated zones, which may assist in the identification. Zone 16 stations are UA9, S and T, Zone 17 are UA9A B C D J M Q and X. Zone 18 stations are UA9H O P U V Y A B O S T. Zone 19 are UA0C G E F I J K L M Q R and Z, whilst the elusive Zone 23 stations all begin with UA0Y. Substitute UK0 and UK9 into the Zones as shown.

YB9AAJ puts a really fine signal into this QTH, usually around 1000z. He asks for QSLs to go to manager W7VRO, but I heard him in QSO with ZM1SV say to send the card to Box 99, Wewak, TPNG., as he visits there regularly. This is a better proposition for the VK as we can get away with Commonwealth rates and a fast mail service.

There is not a lot of news to hand this month, so I will take the opportunity of giving some of those QTHs which I held over from last month. I will not list them in any order, but they will be printed just as I take them from logs and letters.

SOME QTHs

EA5CV—Nr 10, Plaza de Pana, Cartegena, Spain.
XW8CY—Box 25, Vientiane.
TG4SR—Box 20, Chimalbengo, Guatemala.
YB1AN—Box 288, Bandung, Indonesia.
WA5KPL/HR1—Bob, C/o. U.S. Embassy, Tegucigalpa, Honduras.
KL7GRF—Rural Route 1, Box 142B, Ketichican, Alaska.
KX6HW—Box 141, APO San Francisco, 96555, U.S.A.
EA8GK—Box 860, Las Palmas, Canary Is.
KA9JC—Via KA9MF, Box 558, FEARL Bureau, APO San Francisco, 96525, U.S.A.
EA8GZ—Cristina Labin, Casilla 21, Icod, Tenerife.
HC2SO—APTO 184, Guayaquil, Ecuador.
HT1AJP—APTO 434, Managua, Nicaragua.
JA3IVC—Masami Okuda, 10 Tangonosho, Yamato-Koriyama, Nara, Japan.
KJ6BZ—Box 436, 24 ADS APO San Francisco, Calif., 96305.
KM6DQ/KH6—Box 100, FPO San Francisco, Calif., 96614.
MP4BIA—Box 116, Manama, Bahrain Is.
OA4RQ—APTO 438, Lima, Peru.
OA6BS—APTO 700, Arequipa, Peru.
OA0BC—APTO 1841, Lima, Peru.
OH2BH—Angervoite 8-B-17, Helsinki, Finland.
UA9VH/JT1—Box 639, Ulan Bator, Mongolia.
VP2AN—Box 394, St. Johns, Antigua, British West Indies.
VP2MB—Box 16, Plymouth, Monsterrat, BWI.
VR4EE—Box 9, Honiara, Guadalcanal, Solomon Is.
WS6DI—Box 788, Pago Pago, American Samoa, 96920, Pacific.
YK1AA—Box 35, Damascus, Syria.
YV3VN—APTO 625, Barquisemento, Lara, Venezuela.
3A2CN—41 Blvd. de Jardin, Exotiquo, Monaco.
3Z0L—Box 298, Warszawa, Poland.
5H3KA—Rev. Ward, Box 939, Arusha, Tanzania.
9J2RQ—Box 401, Ndola, Zambia.
6W8BA—Box 3013, Dakar, Senegal Republic.
6W8XX—Box 971, Dakar, Senegal Republic.
7X2AL—B.P. 2, Alger, Algeria, Nth. Africa.
8QAYL—Mrs. Soma Wickremashinge, Male, Maldive Is.
9K2BF—Box 1083, Kuwait, Arabian Gulf.
9G1GD—Box 22, Nsuta, Wassaw, Ghana.
9Y4PL—Box 1167, Port of Spain, Trinidad, Sth. America.
ex-5N2ABF and ABI—F. Inks, 1 Staples Way, Houston, Texas, 77027.
9N1RA—Box 81, Kathmandu, Nepal.
9J2NC—Box 124, Lusaka, Zambia.
HS0ISB—Box 2008, Bangkok.

A note here for Swl's. I have for the past couple of years handled the inward QSLs for VK2 listeners, and any other Swl's W.I.A. members or otherwise. This is not a big job and it is no trouble to do it. However, it is often difficult to locate the addresses of some of the W.I.A. members as we don't have a list to work from. If the following members would drop me a line with their correct address, plus a stamped envelope I will forward on cards which I hold for them: L2047, 2049, 2069, 2158, 2230, 2342, 2949 and 5087.

And so we come to the end of another month. My thanks to ZL2AFZ, Don AX3AKN, Jack AX3AXQ, Jock AX1LF, Tom AX3BBC, Geoff Watts DX News Sheet, LIDXA, Stew Foster of Monitor for QTHs, and Steve Ruediger. Good DX and 73 de Don L2022.

☆

PROVISIONAL SUNSPOT NUMBERS

JUNE 1970

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	102	16	149
2	92	17	143
3	64	18	123
4	63	19	98
5	59	20	95
6	57	21	90
7	58	22	105
8	61	23	77
9	60	24	102
10	92	25	126
11	127	26	127
12	148	27	114
13	160	28	113
14	182	29	122
15	185	30	111

Mean equals 106.8.

Smoothed Mean for Dec. 1969: 105.6.

Predictions of the Smoothed Monthly Sunspot Numbers

July	96	October	90
August	94	November	88
September	92	December	86

—Swiss Federal Observatory, Zurich.

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the Award:

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
554	YV1YC	622	K4HFP	690	K8YRV
555	YV1YD	623	WA5ZRB	691	AX3ASV
553	WA0OAH	624	K3ARM	692	AX3BAZ
557	W1HOO	625	W2HF	693	ZL1AGO
558	G3PPP	626	W7VRO	694	HA5DA
559	VE5ZD	627	AX4QA	695	G6JY
560	G3EFC	628	W0CDC	696	ZM2ANA
561	JH1MTQ	629	WB6ZWS	697	PZ1CU
562	W5OLG	630	W8KPL	698	WA8QIY
563	VE7TL	631	AX3XD	699	AX3ACD
564	W0QZI	632	G5HZ	700	W7VXG
565	8P6AZ	633	AX2AND	701	AX3LC
566	VE3CBG	634	K6YUI	702	ZM1DS
537	AX3OW	635	W6KDK	703	W9WCE
563	ZM3GS	636	KL7DNE	704	G3KYF
569	DK2MO	637	AX2AFA	705	MP4BHL
570	AX3AAO	638	AX5ZZ	706	K1OZR
571	K6SSN	639	AX3AKC	707	AX3AUN
572	AX5AZ	640	3B8CZ	708	ZM1BJO
573	W0SFU	641	AX2ARQ	709	VS6AI
574	W6UWP	642	AX4EZ	710	AX1AR
575	W4AXE	643	AX2APP	711	G3IFB
576	W1RAN	644	WA4SCJ	712	ZL2APM
577	DJ0KQ	C45	AX3ASI	713	WA3HUP
578	G3XJN/M	646	AX3RJ	714	G6VQ
579	AX5MB	647	WA8EDC	715	WB6IUH
580	JA6LUT	648	KL7GSC	716	VE2BBP
581	AX2AU	649	ZM2AH	717	W9UX
582	W2IXT	650	ZM3ADN	718	AX3AUJ
583	W8GKM	651	DJ4PI	719	W9RYK
584	W3KO	652	AX4GG	720	WA5RAS
585	WA8TND	653	AX3YC	721	VE5AZ
586	K4IEX	654	AX5RG	722	W3RZ
587	W9ETP	655	WA4CGD	723	K4LAN
588	LU5AQ	656	AX3AMA	724	AX2BPG
589	G3GKA	657	AX4FE	725	WA2DHS
590	EL2CB	658	AX6KR	726	G3RXC
591	WA9ZCP	659	G3VTQ	727	3B8CV
592	VE0NEF	660	DJ3CN	728	WA5SVH
593	W8VHY	661	9G1GT	729	AX4TT
594	W3CJF	662	AX2AAL	730	K8QYG
595	W8ZXL	663	AX6DR	731	VE4AE
596	W9LNQ	664	VE8RCS	732	WB6ZDF/
597	VE4XQ	665	OK2SFS		KG6
593	W4WSF	666	AX3BDH	733	AX2EW/M
539	K0BLT	667	G3IDW	734	I1ADN
600	K5BPY	668	WB4MKB	735	DJ2MV
601	W2CUC	669	DL8MM	736	AX4RT
602	K4EKJ	670	G3EDM	737	W4JV
603	W6YMV	671	AX9GA	738	W9RKP
604	XE1ER	672	W1IMP	739	WA3HGV
605	W2PFL	673	W8AQZ	740	HS4ADB
606	3B8CR	674	AX3AUL	741	AX4EV
607	K4DXO	675	VE3BSR	742	G3GLM
608	WB9BXQ	676	G3UGC	743	PZ1AK
609	W3ABI	677	CT1LN	744	VS6FX
610	HB9AAA	678	AX3BBC	745	AX2GR
611	AX4UG	679	AX4IO	746	AX6WY
612	I1BOX	680	AX4KX	747	HB9UO/W6
613	G3LQB	681	W4WWG	748	AX5GX
614	WB6DXU	682	WA2NRD	749	VE3DUL
615	W9JYU	683	WA2BTJ	750	VE3BSJ
616	VQ8CZ	684	AX4FU	751	ZM4CP
617	ZM1BII	685	AX2BDN	752	AX4IE
618	W7EKM	686	AX2ATM	753	G3GHE
619	ZM4CR	687	AX4MW	754	AX2ACT
620	VE6ZW	698	K6PZ	755	VE3EU
621	ZM1AMQ	639	W3CKH	756	G3JZI

COOK BI-CENTENARY AWARD V.H.F./U.H.F. SECTION

The following stations have qualified for the Award:

Cert. No.	Call
1	AX3ZNJ
2	AX5ZBT
3	AX4ZAL

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

TO MALTESE EMIGRANTS

3914 Casgrain Drive,
Windsor, Ontario, Canada.

Editor "A.R.," Dear Sir,

A large number of Maltese emigrants settled in Australia during the last 25 years. The Maltese Amateur Radio International Society is now being formed and is looking for Maltese Amateurs in every part of the world. With a population of over 100,000 Maltese Australians, I am sure that a number of these are either Hams or will be interested in knowing that the M.A.R.I.S. is now being formed.

I am hoping that you will be able to help by giving us some space in your Federal magazine "Amateur Radio" which goes to every affiliated club in Australia and to about 4,000 Hams across the country.

We are planning to select the Directors in the early part of next year and we are hoping to have a Director from each continent. We are now setting up the by-laws, frequency of meetings, affiliations with various wireless institutes, etc. We also have a supply of three coloured QSL cards which will be available at a very reasonable cost to all members.

Thanking you in advance, and hoping that the response will be great, for further information, anyone can write to me at the above address.

—G. N. Muscat, Founder/Director.

[Licences are available to all naturalised migrants.—Ed.]

W.I.A. D.X.C.C.

Listed below are the highest twelve members in each section. Position in the list is determined by the first number shown. The first number represents the participant's total countries less any credits given for deleted countries. The second number shown represents the total D.X.C.C. credits given, including deleted countries. Where totals are the same, listings will be alphabetical by call sign.

Credits for new members and those whose totals have been amended are also shown.

PHONE

VK5MS	316/340	VK5AB	297/314
VK6RU	314/339	VK4FJ	287/307
VK4HR	313/332	VK4TY	284/288
VK3AHO	311/326	VK2APK	281/287
VK6MK	303/323	VK2AAK	272/277
VK4KS	300/315	VK3TL	271/277

Amendments:

VK4UC	237/237	VK4RF	185/185
VK4PX	234/235	VK7LZ	177/184
VK3AMK	226/226	VK2AGH	113/124

New Members:

Cert. No.	Call	Total
111	VK6KK	137/138
112	VK4FH	143/150
113	VK4ZK/9	104/104
113	VK2AMU	99/103

C.W.

VK3AHQ	301/315	VK3YL	276/293
VK2QL	300/323	VK3NC	274/300
VK4FJ	290/315	VK3XB	270/287
VK4HR	289/311	VK3ARX	270/279
VK2AGH	282/296	VK6RU	266/289
VK2APK	280/288	VK4TY	259/272

Amendments:

VK4RF	165/177	VK4PX	106/110

OPEN

VK4HR	316/341	VK6MK	304/324
VK6RU	315/340	VK2EO	302/325
VK2AGH	314/334	VK4KS	301/325
VK2VN	308/326	VK2APK	298/309
VK4SD	306/321	VK4FJ	298/323
VK4TY	306/321	VK3ARX	297/306

Amendments:

VK4UC	271/272	VK4RF	230/242
VK4PX	245/250	VK6HD	154/154
VK7LZ	238/259	VK3QV	121/121

New Members:

Cert. No.	Call	Total
126	VK6HD	112/112
127	VK6KK	149/151
128	VK4FH	163/172
129	VK2PA	104/112

MORE MISSING NAMES

Editor "A.R.," Dear Sir,

The No. 4 person in the photograph is myself and I was owner and operator of station 2ED at Walton Crescent, Abbotsford Point, N.S.W., wavelength 220 metres.

I believe that No. 2 person in the front row was Mr. C. P. Bartholomew, he was President of the Wireless Institute of N.S.W., and also a Director of Amalgamated Wireless Australasia Ltd. as well as a Director of Beard Watson & Co. Ltd.

Suggest that No. 9 person in the back row was Sid Colville, of Colville & Moore Radio Supplies, Rowe Street, Sydney.

—Harold R. Gregory.

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